

NEW ZEALAND JOURNAL OF
Agriculture
AUGUST - 1951

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Cooper News

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NEW ZEALAND JOURNAL OF Agriculture

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Minister of Agriculture.

This Month's Cover



Peat areas occur throughout New Zealand. Within 20 miles of Hamilton there are 50,000 acres of waste land in peat swamps and another 50,000 acres of peat in pasture of low productivity. Research into methods of developing these swamps is a major project at the Department of Agriculture Rukuhia Soil Research Station, Hamilton. This month's cover, which has been reproduced from a colour photograph by Sparrow Industrial Pictures Ltd., shows research workers measuring growth on an experimental pasture on raw peat 30ft. deep. Eighteen months previously this was waste land. Last summer and autumn this pasture with the right fertilisers and controlled water level produced as much dry matter as spray-irrigated Waikato pastures.

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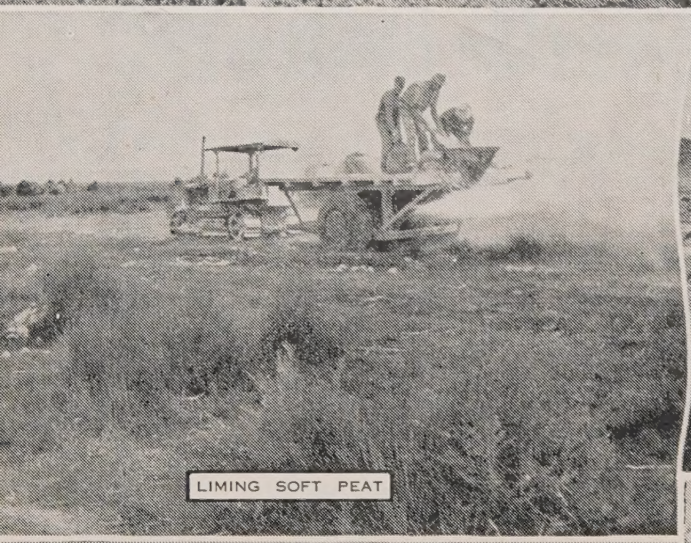
PEAT LAND RESEARCH AND DEVELOPMENT



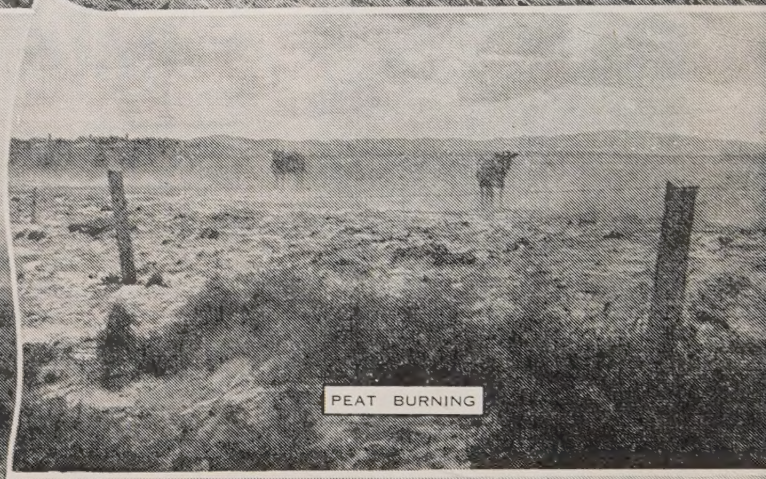
ACCESSIBLE UNDEVELOPED PEAT



CRUSHING SCRUB



LIMING SOFT PEAT



PEAT BURNING

Research work at the Department of Agriculture Rukuhia Soil Research Station, Hamilton, has given much information on factors limiting pasture growth on peat land. By the use of the right fertilisers good clover growth can be maintained on peat. The deficiency of available nitrogen in the peat is thus overcome and ryegrass can thrive. Control of the water level to avoid waterlogging in winter and over-drainage in summer is essential for best results.

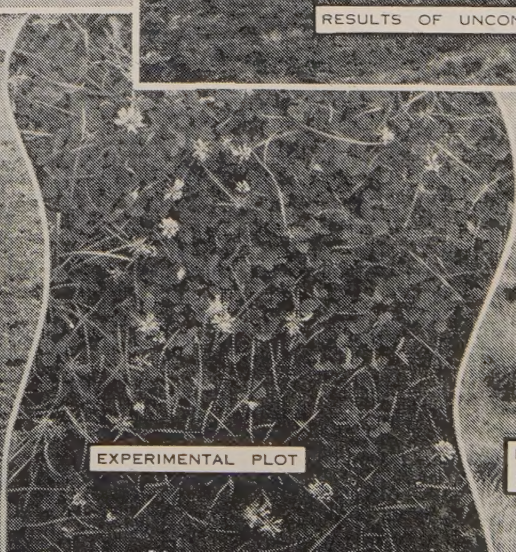
[Photograph second from top at right by Sparrow Industrial Pictures Ltd.



RESULTS OF UNCONTROLLED BURNING



STUMPS A PROBLEM



EXPERIMENTAL PLOT



PEAT AT OPIKI, NOW USED FOR VEGETABLE PRODUCTION

A Servant of Agriculture Passes

WITH the death of Sir Albert Ellis in Auckland last month there passed from the New Zealand agricultural scene one whose life work has had a marked effect on the pattern of our primary production.

The son of a Waikato farmer, Albert Fuller Ellis accepted an engagement toward the end of last century as analyst and prospector with a London company trading from its Sydney office in island products, including phosphates. At a stage when the company's phosphate deposits worked on successive islands were of such small extent and so poor in quality as to be unpayable, Sir Albert was transferred temporarily to the Sydney office of the company, where he made the sensational discovery leading to the development of the Nauru and Ocean Island deposits with which his name is so closely linked. Sir Albert has described in his book "Ocean Island and Nauru" the fascination exercised on his mind for 3 months by the large piece of "fossilised wood" that propped the laboratory door open. Fortunately he eventually yielded to the temptation to conduct the usual tests for phosphoric acid content, and the strong reaction spurred him on to investigations that led to the discovery of extensive deposits of phosphate rock of the highest quality at Nauru and Ocean Island. These are the prosaic circumstances, not unmixed with the very human characteristic of curiosity, which led to the establishment of a legend which surrounded Sir Albert throughout his lifetime.

Though Sir Albert's discovery meant assured success and rapid development of his company, his recorded reactions at the time illustrate that his roots were still in the land, and the end use of the deposits dominated his thoughts: "Here was material in scores of millions of tons which would 'make the desert blossom like the rose', would enable innumerable hard-working farmers to make a living, and would facilitate the production of wheat, butter, and meat for hungry millions for the next hundred years to come".

When the Governments of the United Kingdom, Australia, and New Zealand acquired the phosphate interests at Nauru and Ocean Island in 1920 Sir Albert was appointed New Zealand Commissioner. In an article in the "Journal" last year he wrote, "The production of this vital aid to agriculture [phosphate] entails work calling for much enterprise and careful planning, nor is the element of high adventure wanting." The qualities which he brought to his task during his 30 years with the Commission have earned for Sir Albert a high place in the esteem of the Government and the farmers of his country.

Before the war the amount of phosphatic manures applied annually to New Zealand pastures had increased from about 270,000 tons in 1926-27 to about 650,000 tons in 1939-40. In the same period the total area of our grassland topdressed increased from a little over 2½ million acres to over 4 million acres. A continuous supply of phosphatic rock from Nauru and Ocean Island had become essential to our agricultural well-being. The demands of New Zealand were well



Sir Albert Ellis.

met by the British Phosphate Commission, whose installations at Nauru and Ocean Island had reached a production of 1¼ million tons by 1939.

The destruction of the installations at Nauru and Ocean Island during the war and their occupation by enemy forces must have been a bitter personal blow to Sir Albert; the efficient facilities which had been developed over many years were rapidly rendered useless. The effect on production from our grasslands threatened to be grave. That supplies of phosphate, though inadequate, were able to be continued was due to the efforts of Sir Albert and the Commission in their prompt action to procure alternative sources of supply.

The efficiency and speed with which rehabilitation of the Commission's installations at Nauru and Ocean Island after the war was achieved were again a personal tribute to Sir Albert, who visited the islands immediately on their liberation and accepted the enemy's surrender. Plans for resuming operations at the islands were formulated and equipment and technical skill assembled long before the war was won, and a restitution task force was able to proceed to the islands at the earliest possible moment. Production from the rapidly restored facilities increased at a rate that exceeded the most optimistic hopes.

During the days when fertiliser supplies were inadequate and our food production effort was threatened, the services and advice of Sir Albert and his associates were freely available to the Government. I am glad to pay a tribute on behalf of New Zealand farmers to a lifetime of devotion to a great enterprise and the service of primary production which won for Sir Albert the recognition of the King and the esteem of his fellow-countrymen.

K. J. HOLYOAKE, Minister of Agriculture.

Pastures and Pasture-seed Production in Great Britain



THE lowland pastures of Great Britain are closely similar to those of New Zealand, partly because the climate of both countries is temperate, and partly because farming in New Zealand has developed by the adoption of British practices in which the use of "English" grasses and clovers and British breeds of livestock has been widespread. The differences which do exist result from the greater emphasis given in New Zealand to pastures for the maintenance and production of livestock.

Dairy cattle on a farm in the English county of Cheshire.

SPECIALISED production of butterfat, meat, or wool forms the greater proportion of New Zealand's agriculture, and for these systems of farming pastures have proved to be the most efficient food supply. In consequence a high level of skill in pasture management has been achieved by the general run of farmers. On the other hand, the British farmer is not a specialist, but a mixed farmer. His combined achievements will soon supply about half the food requirements of more than 50 million consumers. As well as producing milk, meat, and wool, he also produces cereals, potatoes, often vegetables, eggs, pork, and one or more of the industrial crops—sugar beet and linseed.

Dependence on Concentrates

Before the war British agriculture produced about 30 per cent. of the food requirements of the people, but to make this possible large quantities of concentrates were imported for the main part of the production ration of the livestock. Temporary pastures sown in the course of the cropping rotation or the permanent area of grass on the farm were used mainly for summer grazing. Farmers did not have to rely completely on production from pastures, and consequently there was little urge to improve them, but they became highly skilled in the use of the concentrates.

The effect of this difference between the farming systems of the two countries is very evident. At first it comes as a surprise that the standard of the general run of pastures should be so much below the high standard of crop production and livestock husbandry. All natural conditions for good pasture production exist. The soils are of high productivity and the climate during the growing season, from April to October or November, appears ideal for grass growth. The rainfall is generally good and the climate mild and humid. There are very seldom arid periods in the middle of the growing season such as regularly shorten the effective growing season in New Zealand by 1 or 2 months.

PROFESSOR J. W. CALDER is Assistant Director of Canterbury Agricultural College, Lincoln, and head of the Department of Field Husbandry at the college. During 1949 he spent a period of study leave in Great Britain and, as he has had a life-long interest in pastures and pasture-seed production, much of that time he devoted to a study of those phases of agriculture. In this article he draws comparisons between pasture management and pasture-seed production in Great Britain and in New Zealand and warns that the Dominion's seed market in Britain may be in jeopardy.

Except in the south, the winter climate is long, wet, and cold and generally unsuitable for winter-producing animals to remain outdoors as they do in New Zealand. Dairy herds are generally housed in barns or in covered yards and fed on hay, silage, roots, and concentrates. Likewise winter beef production necessitates housing the animals, but this practice is declining in importance because of high costs of concentrates and labour. The by-product of the system of winter cattle production is the farmyard manure which, when applied to the land, plays an important part in maintaining the fertility of the farm.

Before the war concentrates formed a large part of the winter ration. Between 9 and 10 million tons were used annually, most of it imported. In effect, Great Britain was using the surplus production of other countries in the form of concentrates to produce animal products and in the form of the by-product farmyard manure to help to maintain the productivity of the cropping land. In consequence, pastures were used for summer grazing and any deficiency in production was made good by the use of concentrates. This system is sound when cheap stock food can be imported in peacetime.

With this background the present state of British grasslands and the changes which are taking place may be considered in more detail. The lowland pastures can be conveniently classified into permanent pastures and leys.



Harvesting sugar beet (left) and linseed (right) on English farms. The British farmer is not a specialist but a mixed farmer. As well as producing milk, meat, and wool, he also produces cereals, potatoes, often vegetables, eggs, pork, and one or more of the industrial crops—sugar beet and linseed.

Permanent Pastures

A characteristic of English farming, permanent pastures are often more than 100 years old. They vary in type in different regions and also according to their origin. They are rarely limed or fertilised and consist of a collection of good or inferior grasses and clovers together with grassland weeds, including buttercups and daisies. Some have the reputation of fattening a bullock or more per acre in the summer, but the majority fall far short of this.

They are mainly in the higher-rainfall areas of the Midlands and the west, but throughout the country most farms where livestock are carried have an area of permanent grass. Excluding one part of the farm from the cropping area seems a strange arrangement on arable land. The scheme probably originated when pasture establishment was difficult and the adage "To make a pasture breaks a man" had some meaning, but with present knowledge, power, and implements there seems no reason why most of the permanent grass could not be ploughed and brought into the rotation or, if necessary, resown to pasture. The other part of the adage, "To break a pasture makes a man", can be taken advantage of, for it still holds good and, as was amply demonstrated during the war, these old pastures hold a vast store of potential productivity.

Before the war some 16 million acres were in permanent pasture. During the war about 6 million acres were ploughed and brought into the cropping rotation, with highly satisfactory results to the country's food supply. Most of the 10 million acres which remain are likewise capable of development and, though some of the land which is in the old "ridge and furrow" will prove difficult, it can be done with modern equipment. Some of the best will undoubtedly remain for many years, but the development of this large acreage of land with a high potential production holds promise for a considerable increase in home-produced food if this is considered necessary.

The Leys

The term leys is applied to the temporary pastures which occur in the cropping rotation on the farm. Of a total area of 13 million acres of land regularly under the plough before the war, some 4 million acres were in temporary grass. Grassland research had shown that the ley could be highly productive, but farmers generally preferred to rely on concentrates, using the ley for summer grazing without giving much attention to making full use of its potentialities, though the temporary pasture was considered important as providing a period during which the soil was given a valuable rest from cropping.

There were exceptions to this viewpoint. Some pioneer farmers made full use of modern grassland husbandry. During the war, when concentrates were no longer available, their results provided ample evidence of the suitability of ley farming and of improved pastures to provide the main part of the productive as well as the maintenance ration of livestock.

Hay from Pastures

Hay has always been an important product from pastures in Britain, permanent or temporary. Before the war 7 or 8 million acres were cut annually. These areas usually received better treatment in the form of topdressing than the grazed pastures, probably because the results of topdressing could be recorded in increased yields and improved quality. Very little lucerne was grown.

In general, the climate is not the best for making high-quality hay consistently. In consequence hay was used to provide bulk and the maintenance part of the winter ration of productive stock, while concentrates were used for the production part of the ration.



Part of an English pedigree herd. In most parts of Britain dairy herds are housed in barns or in covered yards in winter and fed on hay, silage, roots, and concentrates.

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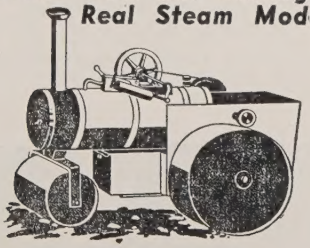
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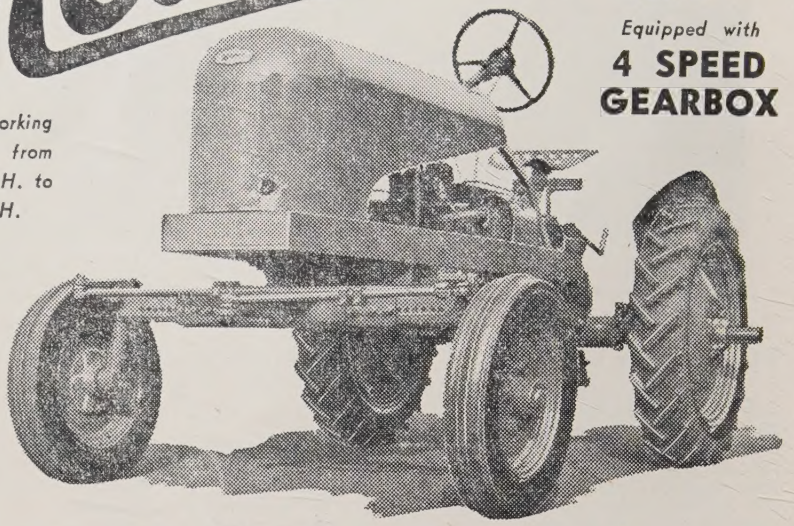
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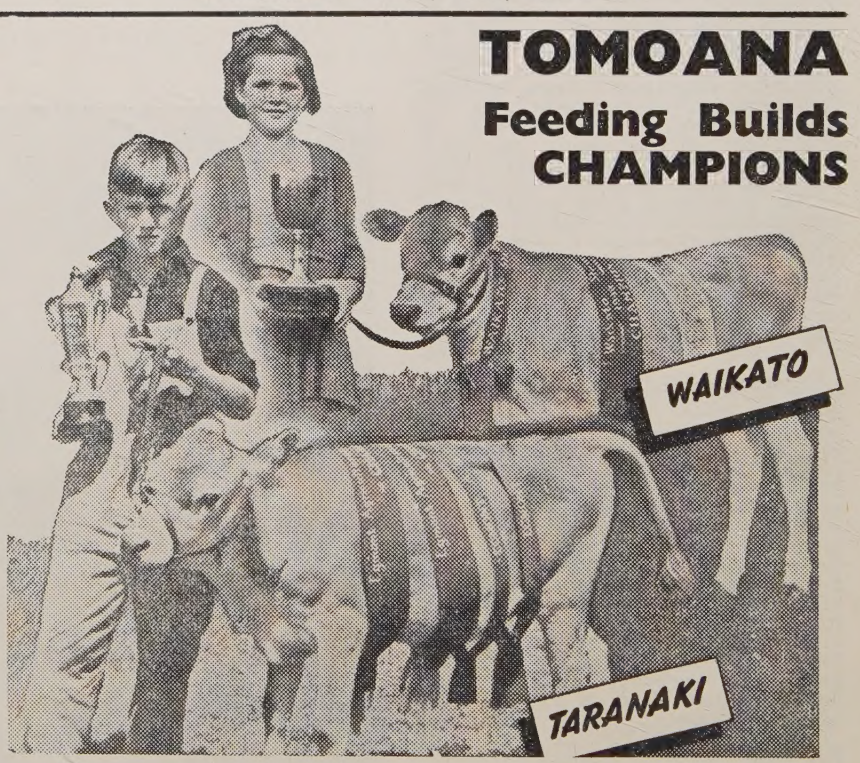


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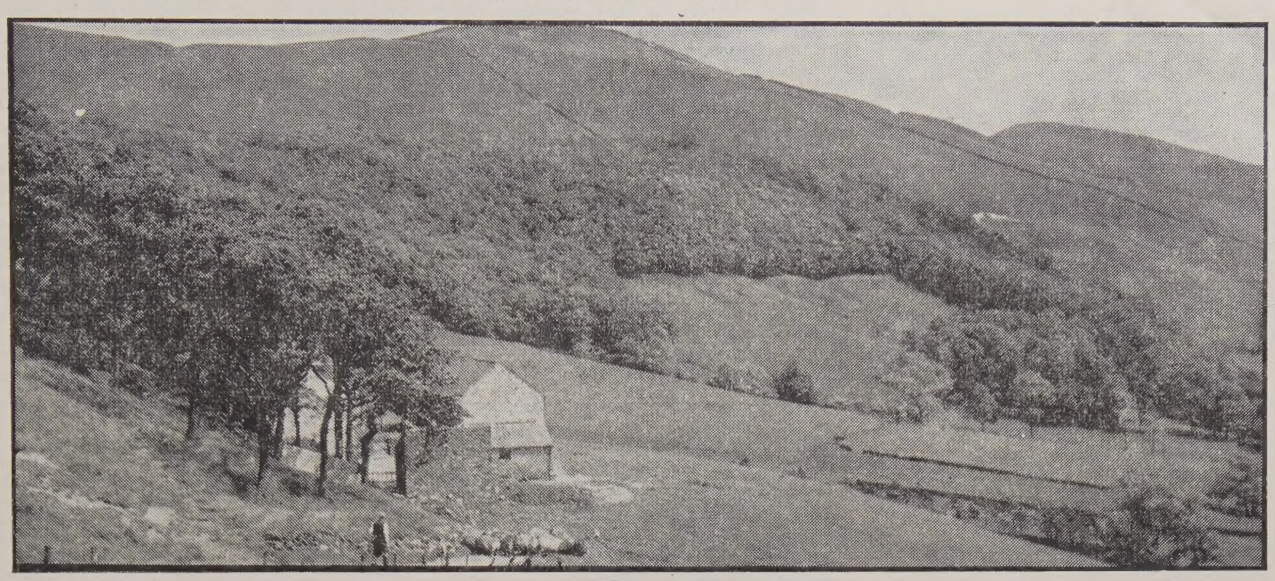
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Before the war pastures in Britain were used for summer grazing and any deficiency in production was made good by the use of concentrates—a sound system when cheap stock food can be imported.

Changes since the War

A revolutionary change in the farmers' outlook on pastures has occurred since the war, brought about by a drastic reduction in the supply of cheap imported concentrates. A national programme of pasture improvement was initiated and is now well advanced. The programme fitted in well with the Government's drive for more home-grown food for the people. It advocated, supported by subsidies, a policy of ploughing up permanent pasture to bring the area into the cropping rotation of the farm and the wider use of improved temporary pastures.

Sir George Stapledon, of the Welsh Plant Breeding Station at Aberystwyth, led the attack on the permanent pasture and advocated ley farming. For some 25 years he and his team of research workers had demonstrated the importance of strain in grasses and clovers, the high productivity of the improved ley, and its fertility-building properties. He also demonstrated the existence of unused stores of fertility under the permanent pasture. The farmers, following the lead of the grassland research workers and the results of a few pioneer grassland farmers, found an alternative food supply in the improved pastures.

Of course, ley farming was not new. It was the system of farming in parts of England and in Scotland, as it is in the arable areas of New Zealand. Its extension to the permanent pasture lands of England and the greater emphasis now given to pasture production are in the nature of an agricultural revolution. Some 6 million acres of permanent grass were ploughed up, adding to the area of arable land, and the area in leys has increased to nearly 5 million acres.

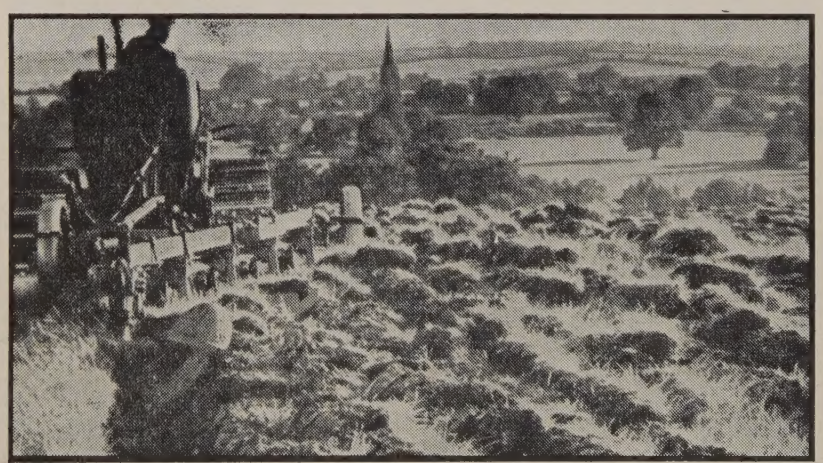
Pastures cannot provide all the ration for winter-milking animals, and some form of concentrates and supplementary feeds is necessary. A small quantity of concentrates is fed, but a major development designed to supply the productive part of the ration has been an increase in the use of grass silage and dried grass made from the improved leys. Lucerne for grazing, hay, silage, and drying is increasing slowly in popularity as farmers learn to grow and use the crop, but most of the silage and dried grass is cut from the improved leys. In general, conditions for grass growth are as favourable as, if not more favourable than, those of the South Island of New Zealand, so when ley farming does get under way on modern lines a big change in agricultural production is likely to follow. Large quantities of Certified pasture seeds will be required annually to maintain the system.

Pasture-seed Requirements

Present annual requirements of grass and clover seeds, based on figures from official sources by Gwilym Evans, of the Welsh Plant Breeding Station, are as follows:—

	Tons
Perennial ryegrass	15,000
Italian ryegrass	6,000
Mixed ryegrass	1,500
Cocksfoot	3,000
Timothy	2,500
Meadow fescue	300
Dogstail	400
Other grasses	550
Broad red clover (cow-grass)	6,000
Late-flowering red clover .	1,000
Alsike, and alsike and white clover	1,500
Large-leaved white clover	800
Wild white clover	250

These figures indicate an annual total pasture-seed requirement of 35,000 to 40,000 tons. Of this large annual requirement 30,000 to 35,000 tons are produced in the United Kingdom and 4000 to 9000 tons are imported. With the stimulus of high prices a great effort would not be required to produce in the country the quantity of seed at present imported and more.



Breaking up reclaimed grassland overlooking an English town. This wartime process showed that old pastures hold a vast store of potential productivity.

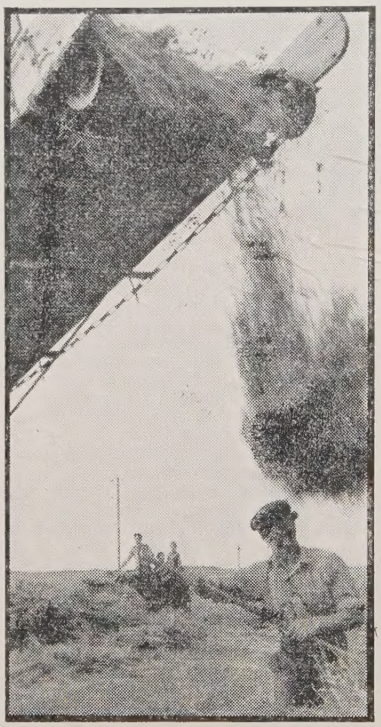
However, the English farmer, as distinct from the farmers of Northern Ireland and Scotland, has not been a big grower of pasture seeds. In the past he has relied mainly on his merchant to supply him with seed imported from Northern Ireland (by far the greatest part), New Zealand, and other countries. The merchant supplies him with ready-made mixtures often consisting of several strains of perennial ryegrass, Italian ryegrass, cocksfoot, and red and white clovers. These mixtures are still sold under proprietary names such as "Cotswold Mixture", "Fill-barn Mixture", and others of special claims. They often carry a tradition derived from the results of the grassland workers of last century who designed the "Cockle Park" and similar mixtures. No doubt some of these are very good for the purpose for which they are intended, but they are something of a mystery to the farmer and are quite unsuitable for seed production. The National Agricultural Advisory Service is recommending more simple seed mixtures for grazing as well as one grass, one clover, or one of each for seed production.

An increasing amount of seed production is being undertaken by seed merchants on their own farms or by contracting with farmers. There is a limited production of seed of recognised reputable local strains such as Kentish wild white clover, Montgomeryshire red clover, Cotswold red clover, Ayrshire ryegrass, and Kentish ryegrass. These local strains are jealously guarded by seed producers' associations, of which some 40 operate throughout the country. A National Seed Certification Scheme is operating under the administration of the Welsh Plant Breeding Station and the Seed Production Committee of the National Institute of Agricultural Botany and in time, no doubt, will include many of the local organisations.

One of the biggest developments which is taking place is the production in England of seed of the Aberystwyth strains of grasses and clovers, which form the basis of the National Seed Certification Scheme. Because of the increased interest being taken in pastures there is a big demand for Certified strains, and this has been accompanied by a great increase in seed production. Aberystwyth seed crops increased from a few hundred acres in 1939 to more than 35,000 acres in 1947, but they still supply only about 15 per cent. of the total requirements.

Seed Production in England

In England seed growing is a relatively new development, in the main based on the production of the high-grade Aberystwyth strains. The workers at Aberystwyth had been studying seed production since their strains were first developed in the early 1930's. When the demand for local seed arose they were able to advise growers who had no previous experience of pasture-seed production how to secure high yields. Growers were encouraged to treat stands as special seed crops. As the climate is mild and humid, seed was sown in spring under a cover crop of barley, another cereal, or linseed. This is a relic of the old methods of pasture establishment and is apparently satisfactory under English conditions, but it is quite unsuitable for general application to grass-seed production in New Zealand, where a dry summer may adversely affect the sowing. Spring sowing has many advantages for clover-seed production on the more fertile soils. Seed growers in England are now beginning to adopt the practice of sowing grass seed pure in autumn after a summer fallow and clover seed pure in spring, both without a cover crop. Some of the stands may be grazed in autumn, but there is very little winter or spring grazing. Ryegrass seed is broadcast at 20lb. per acre on a Cambridge-rolled surface or drilled at 12 to 15lb. in 7in. rows. Cocksfoot is usually drilled at 2 to 4lb. of seed per acre in 21 or 28in. rows or broadcast on a rolled surface under a spring crop. Ryegrass and clover seed is taken for 1 or perhaps 2 years, but



Haymaking on an English farm. Hay has always been an important product of British pastures, permanent or temporary, though, in general, the climate is not the best for making high-quality hay consistently.

cocksfoot and timothy seed may be taken for 2 or 3 years, rarely more. The stands are then ploughed for other crops.

Heavy fertilising of seed stands is widespread. A common application for grasses is 2 to 3cwt. of superphosphate per acre, 1cwt. of potash, and 1 to 2cwt. of nitro-chalk in autumn, and a further 1 to 2cwt. of nitro-chalk in spring. Nitro-chalk is used in preference to sulphate of ammonia. The clovers are fertilised with superphosphate and potash in addition to lime.

The average yields per acre of ryegrasses and white clover are comparable to those in New Zealand, but cocksfoot and red clover yields are higher. In 1947 the yield of ryegrass was estimated at 300lb. of machine-dressed seed per acre (300 to 400lb. in New Zealand), cocksfoot at 350lb. (130 to 160lb. in New Zealand), red clover at 270lb. (70 to 170lb. in New Zealand), and white clover at 140lb. (80 to 136lb. in New Zealand).

The climate is very favourable for growth, but less favourable for seed harvesting than in the arable areas of New Zealand, where a reasonably good dry period can be expected during the ripening season. The English farmer has overcome this defect in his climate to a considerable extent by the use of header harvesters and by the almost universal use of seed driers, owned on an individual or co-operative basis, but seed production is more hazardous than in the seed-producing areas of New Zealand.

Despite these difficulties seed production in England is now very profitable, and large increases in production can be expected if the ruling high prices continue.

Effect on New Zealand Exports

Under present conditions of English agriculture a great deal of attention is being devoted to increasing pasture development. With the greater emphasis which probably will be given to temporary pastures in future years, annual requirements of seed will increase considerably over present consumption levels.

The English farmer can produce high-quality pasture seeds and is developing this industry. To maintain its market for high-quality seeds, New Zealand must compete with the English farmer on a basis of strain quality and price. New Zealand strains are recognised as suitable for use in the United Kingdom, but at present they take second place to home-produced Certified seeds. Should seed production in England be encouraged by protective measures and expand along the lines suggested, the English market for New Zealand seeds cannot be secure, so alternative markets should be developed. New Zealand farmers should also endeavour to produce high-grade seeds at low cost so that the United Kingdom consumer will demand that protection of home-produced seed be removed and that New Zealand products be made available to him.

A high yield per acre is the most effective method of producing seed at a low price per pound. Methods which might be used to secure high yields and produce at a competitive price are: Devotion of more attention to special seed crops, not neglecting the practice of sowing high-grade seed and ploughing and resowing after one or perhaps two harvests; adoption of wide rows and intercultivation for crops of cocksfoot and timothy; and paying much more attention to fertilising crops. At present the benefits, if any, which may follow the use of potash are not known, but it is known that nitrogen will increase yields of the grass seeds. In England nitro-chalk is widely used for this purpose, but sulphate of ammonia is also a suitable form of nitrogenous fertiliser.

New Zealand's main seed supplies of ryegrasses and clovers will no doubt continue to come from dual-purpose pastures (providing grazing and seed), but special seed crops of some of the higher grades of ryegrass and clover are worth considering, as are special seed crops of other grasses and clovers.

Leeks, an Easily Grown Crop

By A. G. KENNELLY, Vegetable Instructor, Department of Agriculture, Dunedin

THE leek is one of the most popular winter garden vegetables because it has a high nutritive value, is easy to grow, is not often troubled by pests or diseases, tolerates a wide range of soil and climatic conditions, and can be grown to mature at a time when, particularly in southern gardens, fresh vegetables are often in short supply.

THE garden leek (*Allium porrum*) is a biennial grown as an annual and is a member of the onion family. It has flat, strongly keeled leaves and is grown for its long, fleshy, blanched stems or leaf bases. It can be grown in garden soils in most parts of New Zealand for harvesting in late autumn, winter, and early spring and throughout the year where conditions are moist enough.

Raising the Plants

Most growers make only one sowing, usually in August, though successional sowings can be made from July to September. A temperature of about 55 degrees F. is desirable and in the colder southern districts the earliest sowing is sometimes made in boxes under glass. Seed can be broadcast thinly outdoors in prepared, well-drained beds and covered thinly or sown about ½in. deep in rows about 1ft. apart. Weeding, cultivating, and lifting are facilitated by sowing in rows.

Other factors being equal, growth is largely dependent on temperature and soil fertility. When sown in the comparatively cool conditions usually prevailing in early spring plants are usually about 12 to 18in. high and ready for setting out in 3 or 4 months. Plants about 12in. long after trimming and about as thick as the little finger are preferable for planting.

For the home garden plants may be obtained in most districts from seedsmen and nurserymen in December and January, but sufficient plants for the average-sized home garden can be raised by sowing a small packet of seed. Half an ounce of seed is sufficient for from 50 to about 100ft. of row, depending on how thickly it is sown. Three or 4lb. is needed for an acre; 3lb. is sufficient if seed is drilled thinly direct in rows 18in. apart.

Planting

The preferred months for planting are December and January. Later planting is not advisable except where autumn and early-winter conditions are mild enough to enable plants to develop to a usable stage.

The plants in the seed-bed should first be watered liberally and after lifting should be graded into groups of even size. Long-necked plants are best. It is usual to trim several inches off the tops of the leaves and sometimes to trim the straggly ends of the roots. Recent research on the trimming of the leaves of some other vegetables in transplanting has not supported the older views on its value in assisting the plant to withstand transplanting, but it facilitates handling and planting.

Plants may be set 5 to 10in. apart; the wider spacing should be used where large specimens are wanted or if the ground has not been heavily manured. Rows should be 12 to 18in. apart, though commercially when horse-drawn or mechanically powered implements are used for cultivation rows are occasionally up to 30in. apart. Few commercial growers plant more than about ¼ to ½ acre at a time because close planting is preferred and the number of plants that can be set out to an acre is very great and the demand, though usually steady, is limited. The following table shows the approximate number of plants to an acre at some planting distances, headlands not being allowed for:—

Spacing of plants in.	Spacing of rows in.	No. of plants
5	12	104,544
6	12	83,120
8	12	65,340
10	12	52,272
6	15	69,796
6	18	58,080
6	30	34,848

To obtain long, tender, white stems it is usual to blanch leeks by earthing up the stems as they develop, but this is not essential to their culture. To obtain especially long blanched specimens home gardeners occasionally use paper collars or field pipes or more rarely peg boards 6in. to 8in. wide around the beds and gradually fill the enclosures with soil. Blanching does not stop growth.

There are several ways of planting. In free-working, deep, well-drained soil leeks may be dropped into holes made with a trowel or a blunt dibble in a shallow drill so that only the top inch or two of the leaf shows above ground. They should be watered immediately, and if a dibble has been used, the filling of the holes can be left to the natural erosion of the soil. Alternatively, they can be planted 5 to 10in. apart in a double row in a trench 10 to 12in. wide and, depending on the depth of fertile soil, about 6 to 12in. deep. They should not be set too deeply in heavy, sticky soil. In shallow soils they are best planted shallowly and earthed up as they develop. They can also be sown where they are to mature, the thinnings being used for soups and stews and the remaining plants earthed up. Commercially they are occasionally planted in furrows opened with a plough in cultivated soil.

Beds are neater if plants are set uniformly so that all leaves are at right angles to the line of row or all are pointing along the line of row. If the leaves point along the line of row, there is less likelihood of damage being caused through walking between the rows, but the plants should then be given wider spacing in the row.

Apart from weed control and perhaps watering and earthing up, leeks planted in fertile, well-manured soil should require no further attention after planting.

Soil and Manure

Leeks can be grown in a wide range of soils that have adequate moisture, plant nutrients, and drainage. Deep,



[*Green and Hahn Photography Ltd. photo.*

Part of a commercial block of well-advanced leek plants earthed up.



[*Green and Hahn Photography Ltd. photo.*

If leeks with long blanched stems are required, earthing up the stems is effective. Earthing up can be done in stages as the plants develop.

well-drained, highly fertile, easily worked soils are preferable. Growth is restricted in heavy, sticky soils, and in light, shallow soils there may be insufficient soil for blanching and the roots may dry out and force early seed head development.

High fertility is essential to good growth, and deep cultivation is advisable on most deep soils. Soils dressed, preferably some time before planting, with organic manure such as well-rotted stack bottom or stable or farmyard manure are excellent. Leeks are, however, gross feeders, and whether or not "natural" organic manure is applied before planting, in most soils mineral or artificial fertiliser should be applied, as the heaviest yields are usually obtained from soils well supplied with well-rotted organic matter supplemented by artificials.

Most commercial growers plant leeks on highly fertile ground that was heavily manured for a previous crop such as celery. Where additional fertilisers are necessary blood and bone at up to a ton to the acre (7½oz. to the square yard) is usually applied.

In the home garden where organic manures such as stable, fowl, or farmyard manures are not readily available a green crop should be dug in early and a complete fertiliser applied. A mixture of 8 parts of blood and bone and 1 part of sulphate of potash or muriate of potash will give good results on a wide range of soils.

Lime

The leek prefers a neutral or nearly neutral soil (pH 6.5 to 7.5), and a dressing of carbonate of lime applied every second or third year at the rate of about ½ to 1 ton per acre (about 4 to 7½oz. to the square yard), depending on the extent the lime is leached out of the soil, is usually adequate. Heavier dressings may be advisable in high-rainfall districts.

Harvesting

Leeks mature in from 28 to 32 weeks from sowing, according to variety and cultural conditions. They stand well in cool, moist soils and can be dug as required, as they remain in good condition for many months. Harvesting should be completed before the flower stalk begins to develop in spring.

The crop is usually dug by hand, but commercial growers occasionally plough out each row. Pulling is not practicable, as the plant breaks. After lifting, the fibrous roots should be trimmed off with a sharp knife, dirty or blemished outside leaves stripped off, and the plants washed. If they are to be marketed, they should be sized, tied into bundles usually of three, though there may be up to six in each bundle if the plants are small, and the greater part of the coarse green leaves neatly trimmed off.

Pests and Diseases

Leeks are rarely troubled by pests or diseases. Mildew is occasionally troublesome. Regular spraying with Bordeaux gives a fairly effective control. White tip (*Phytophthora porri*) causes the tips of the leaves to take on a watery appearance and then die and become blanched and papery. The leaf margins may also become affected and the leaves twisted. Attacked plants are usually stunted and worthless and should be removed early and burnt. White tip can be controlled by spraying with Bordeaux at intervals of 2 to 3 weeks, but rotations should be as long as possible; at least 3 years should elapse before affected ground is planted with leeks. The disease is most likely to occur on badly drained ground during a wet period.

Varieties

British and French seed firms have produced some outstanding strains of leeks, though only a few varieties are listed by New Zealand seedsmen. The leading types are:—

London Flag (syn. Flag, English Flag, American Flag, and Broad Flag): This is a very old variety with broad, soft, bright-green leaves. It is less hardy than Musselburgh, though it is hardy in most parts of New Zealand where vegetables are grown.

Musselburgh or Scotch: A selection of London Flag, Musselburgh develops a long, thick stem and has large leaves somewhat narrower and longer than those of London Flag.

Lyon: This variety is larger and slower to develop than London Flag and is suited to a late crop and for blanching and exhibition. **Prizetaker** is a selection from it.

Carentan or Giant Carentan: This has thicker and darker-green leaves than London Flag. It is a short, thick leek of French origin and is of fine quality.

Radio Broadcasts

A RADIO broadcast will be given to farmers from Station 1YZ Rotorua at 7.15 p.m. as follows:—

September 13—"Matamata District Young Farmers' Clubs' Committee", by the secretary of the committee, R. Clarke, Department of Agriculture, Matamata.

Talks will be given from Station 3YA Christchurch at 7.15 p.m. as follows:—

September 17—"T.B. Testing of Town Supply Dairy Herds", by A. G. Brash, Veterinarian, Department of Agriculture, Christchurch.

September 20—"Preparing the Woolshed and Machines for Shearing", by I. Miller, Sheep and Wool Instructor, Department of Agriculture, Christchurch.

Broadcasts will be given to farmers from Station 4YA Dunedin at 7.30 p.m. as follows:—

September 12—"Some Aspects of Land Development", by J. G. Richards, Instructor in Agriculture, Department of Agriculture, Balclutha.

September 26—"Management of Young Poultry Stock", by W. G. Proudfoot, Poultry Instructor, Department of Agriculture, Dunedin.

A radio talk will be given to farmers from Station 4YZ Invercargill at 7.15 p.m. as follows:—

September 17—"Bees", by S. Line, Apiary Instructor, Department of Agriculture, Invercargill.

Other talks are given from 1YA Auckland on Tuesdays at 12.35 p.m., 1YD Auckland on Thursdays at 7.30 p.m., 1XN Whangarei on Mondays and Wednesdays at 8.10 p.m., 1XH Hamilton on Mondays at 8.45 p.m., 2YZ Napier on Tuesdays at 7.10 p.m., 2YA Wellington on Thursdays at 12.35 p.m., 3YA Christchurch on Mondays at 12.20 p.m., 4YA Dunedin on Thursdays at 12.35 p.m., and 4YZ Invercargill on Mondays at 12.35 p.m.

Pig Broadcast

Under the auspices of the Bay of Plenty District Pig Council a broadcast will be delivered in September as follows:—

Rotorua—1YZ, on September 27, at 12.35 p.m., "Questions and Answers", by A. F. Barwell, Supervisor, Bay of Plenty District Pig Council.

"FARM DAIRY INSTRUCTION"

Bulletin No. 347, "Farm Dairy Instruction", a new publication of the Department of Agriculture, is a useful addition to the list of bulletins about the dairy industry which have been issued by the Department.

It describes concisely the history and objectives of farm dairy instruction in New Zealand, method and practice of instruction, milking process and treatment of milk and cream, grading, faults and remedies, and cleaning of milking machines and dairy equipment. Copies of the bulletin, which is free, can be obtained from the nearest office of the Department.

Designs of Nest Boxes for Poultry Flocks

THE aim of every poultry keeper should be the production of first-quality, clean eggs, and efficient types of nests are very important in helping to achieve that aim. Types of nests suitable for New Zealand conditions are described in this article by H. H. Watson, Poultry Instructor, Department of Agriculture, Oamaru.

NESTS should be constructed so that they are easily dismantled to be cleaned and disinfected and can be given immediate attention to eradicate vermin without the necessity for breaking the nests. Little more material or labour is needed to make an efficient nest and, in the long run, it pays dividends, for inefficient nests can decrease profits through cracked, broken, and soiled eggs as well as being a breeding ground for red mite and other vermin. Efficient nests in use on many farms range in size to suit all conditions from the backyard pen to the commercial farm.

On many farms insufficiency of nesting space for the number of birds housed causes birds to overcrowd into available nests or lay on the floors of pens. At times this has been responsible for vent picking, which, if left unchecked, may lead to the more serious trouble of cannibalism. A bird laying its egg on the floor of the pen offers a temptation to other birds to pick at the fleshy vent, often with fatal consequences to a valuable bird. Ample nesting space and well-constructed nests are therefore necessary, and as hens prefer privacy when laying, semi-darkness in the nests is desirable. Nests that are exposed to too much light can also lead to trouble, for a "cannibal" will walk along the platform waiting for a bird to lay and attack it as it would a bird laying on the floor.

With the continuing improvement in the egg-laying ability of strains and the steady endeavour to improve egg size, slight hemorrhages caused by minor ovary and oviduct troubles are likely to occur, especially in new pullets coming into production. That emphasises the need for a hygienic type of nest.

When 4-gallon petrol and kerosene tins were readily available they were cut down and made good nests which were easy to move for cleaning and disinfecting. Even then two or more birds sometimes crowded into one nest, for birds often like one nest in particular. A very popular type of nest today is the "community" nest, in which several birds can lay in one compartment at a time, thus avoiding overcrowding.

All nests should have provision for being closed at night. In many cases the shutters can be hinged so that they serve as a step or landing perch during the day and can be folded up at night to prevent birds from entering. Sloping tops on nests stop birds from roosting there at night. Perches, not nests, were designed for birds to roost on. Birds perching on nests greatly increase the risk of red mite spreading.

It is not advisable to have nests so high that it is a strain for birds, especially new pullets, to reach them. High nests also make egg collection difficult.

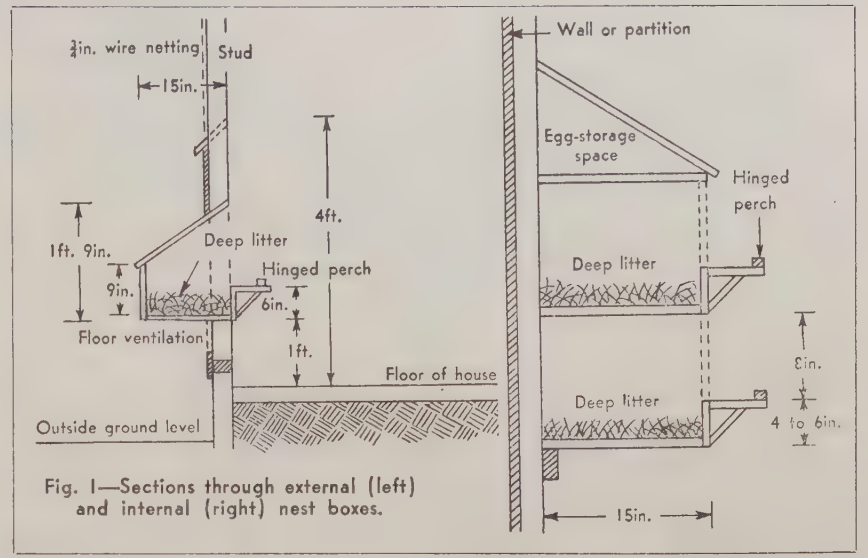


Fig. 1—Sections through external (left) and internal (right) nest boxes.

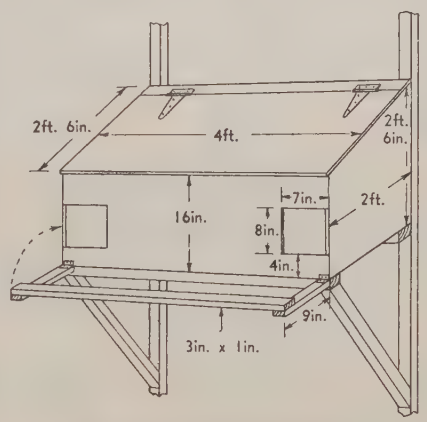


Fig. 2—A community nest.

The plans and measurements of efficient nests which follow cover requirements in various types of laying houses.

External and Internal Nests

External and internal nests which can be installed at the front of the fowlhouse below the netting are shown in Fig. 1.

The internal nest can be fitted on a partition or end wall. The deep litter used for nesting material in the internal nest can be wheat husks, oat shells, or sawdust. The hinged perch can be closed at night to prevent birds from entering the nest and when down acts as a step. The nest can be darkened by hanging sacking cut into 6in.-wide strips over the opening to allow birds to enter and leave without effort.

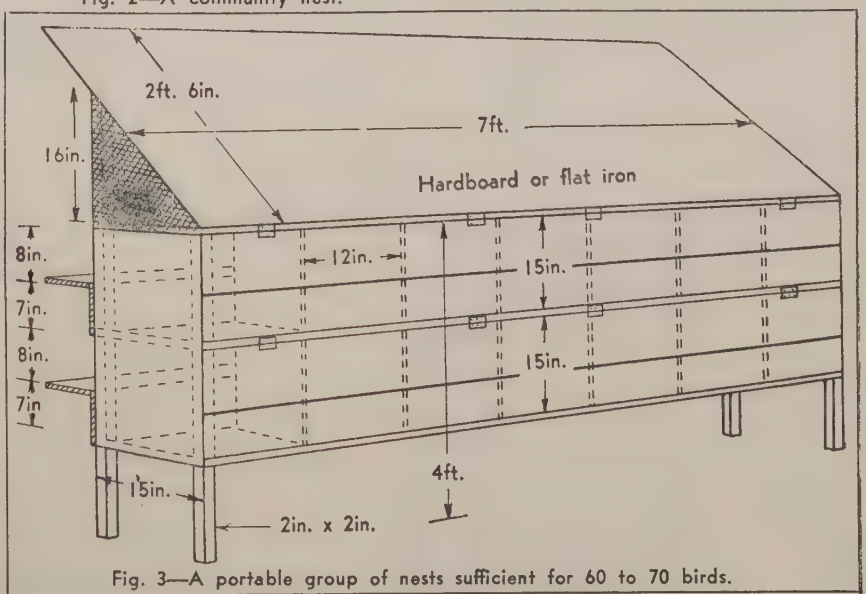


Fig. 3—A portable group of nests sufficient for 60 to 70 birds.

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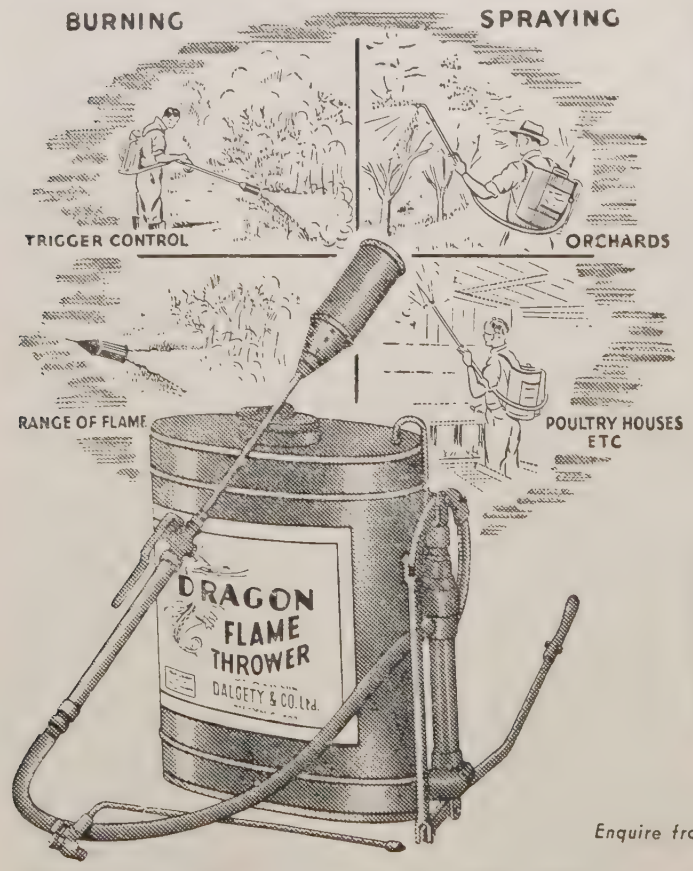
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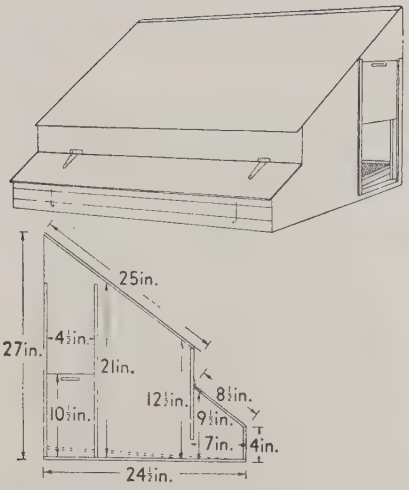


Fig. 4—An Otago farmer's design for a portable nest. The sloping frame down which the eggs roll measures 45in. x 23in. and is covered with ½in. or ¾in. wire netting. It is loose and sits in the bottom of the nest with the rear on the back plate of the nest box. Any timber cut at an angle is at 40 degrees. Divisions can be placed in the nest if desired.

The external nest is entered by the birds from inside the pen. As such a nest becomes warm in summer, it is advisable to fit the bottom with gauze or very fine wire netting on which the litter lies. This allows a current of air to pass into the nest from beneath.

Sections in both these types of nests should be about a foot apart. One nest serves 4 or 5 birds.

Community Nest

The community type of nest shown in Fig. 2 is made of hardboard and 2in. x 1in. dressed timber. Cavings, straw chaff, or oat husks can be used to give good, deep litter, so that the eggs are kept reasonably clean and risk of breakages is reduced. This nest suffices for about 40 birds; a double nest with a dividing partition would give sufficient nesting space for 80 birds. The 3in. x 1in. step in front can be swung into a closed position at night to barricade the nest, which is hung on an end or partition wall.

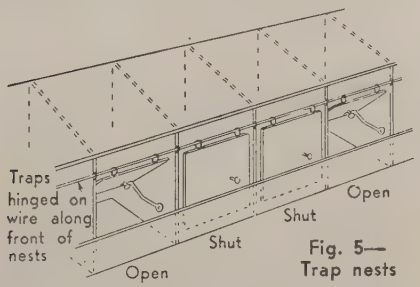
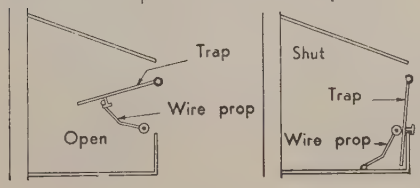
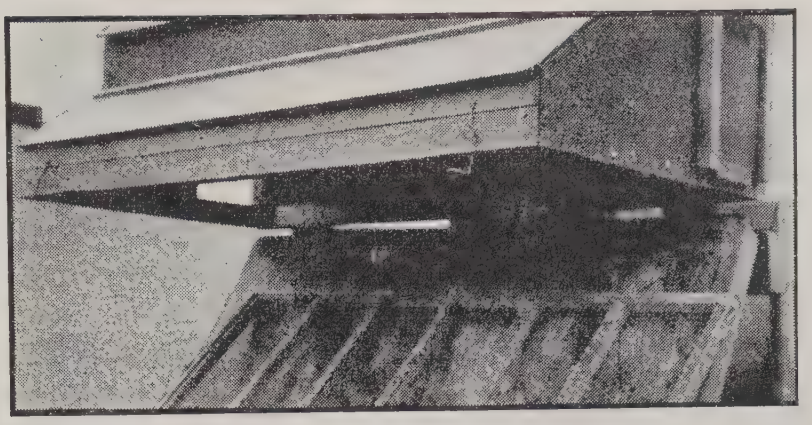


Fig. 5—Trap nests





The trap illustrated at the left with the bottom open.

Portable Nests

A group of nests which can be moved into any position in the fowl-house is shown in Fig. 3. It is best against an end wall. Birds enter along a corridor at the rear of the nests. Eggs are collected through a hinged section along the front; another hinged section below facilitates cleaning. Fine wire netting or gauze can be used for bottoms of nests with 4 to 5in. of litter on top. Dividing sections may be used 1ft. apart, or without partitions the structure may serve as a community nest.

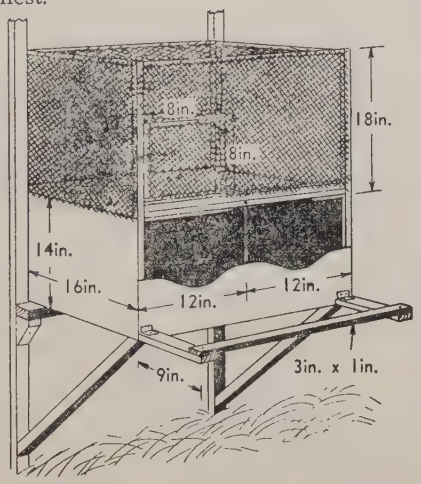


Fig. 6—A nest suitable for a domestic flock of up to a dozen birds, with a broody coop on top. The step in front can be folded up at night.

Otago Farmer's Design

A portable nest designed by a commercial poultry farmer, Mr. W. O'C. Griffiths, of Weston, North Otago, is illustrated in Fig. 4. It is made from hardboard, 1in. x 1in. and 2in. x 1in. dressed timber, ½in. wire netting, and clout tacks.

Birds enter through a trapdoor at the end which can be closed by a slide at night. The birds walk along a passage at the rear and sit on a sloping and adjustable wire netting frame. As eggs are laid they roll to the front of the nest through a 2½in. opening into the egg compartment, from where they are collected. A strip of rubber may be placed at the front of the frame to prevent breakages. This type of nest has proved very popular with the birds and its installation can be recommended before new pullets come into production.

If conditions in the laying quarters are dry, nearly all the eggs laid are clean and, when cooled, can be packed directly into crates for the market. Another good feature is that breakages are reduced to a minimum and, should an egg be broken, the contents drop through the netting frame on to the hardboard bottom, thus preventing the development of the bad habit of egg eating. The bottom of the nest is hinged and so can be cleaned out periodically; the owner sprinkles a mixture of lime and sawdust on it to absorb broken eggs and litter carried in by birds.

Two nest boxes of this type appear to be ample for the 80 to 90 birds on the farm, even with egg production exceeding 60 per cent.

Trap Nests

For progeny testing and laying trials trap nests such as those shown in Fig. 5 are essential. The birds carry numbered rings, and each bird is retained in a nest when it has entered and must remain there until released. The ring number is checked after the bird has laid and the egg recorded. This allows knowledge of birds individually and discovery of a bird that is laying faulty eggs. For example, a White Leghorn may be laying tinted or undersized eggs, and with ordinary types of nest it would be extremely difficult to identify the bird. However, under commercial conditions the use of this type of nest with every pen of pullets is not practicable, as birds must be released every 2 to 2½ hours.

One trap nest for every 3 birds is the proportion advised.

Nest for Domestic Flock

A type of nest suitable for the back-yard poultry owner keeping up to a dozen birds is illustrated in Fig. 6. A nest can be made from a suitable box and fitted to an end wall of the fowl-house. Material such as straw, sawdust, or husks may be used for litter.

If a heavy breed of fowl is kept, a broody coop can be built above the nest. An opening is left at the bottom of the netting, and a flat iron tray that slides in and out facilitates removal of droppings.

Turnips and Swedes: Varieties of Government-approved Seeds

A BRIEF description of the varieties of Government-approved turnip and swede seeds available on the market in October, 1949, was given in the "Journal" of that date. It has been found desirable to introduce a few more varieties so that farmers may be given a wider range from which to select their requirements. The additions now being made to the list were not included during the war years because of their relative lack of importance to New Zealand farming, but with more normal conditions now ruling it has become possible to make the additions to meet these smaller but well-defined requirements. It has also been considered desirable to rename two varieties mentioned in the earlier descriptions to obviate confusion.

THE full list of varieties now available, together with comments on the new varieties and those for which the names have been changed follows.

Swedes

N.Z. Superlative
N.Z. Grandmaster
N.Z. Crimson King
N.Z. Sensation
N.Z. Calder

There has been no alteration in these varieties.

N.Z. Wilhelmsburger (previously N.Z. Resistant): Though this variety shows some resistance to disease, it is only relative, and the possibility of introducing at a later date a variety much more resistant to disease makes it desirable to revert to the name Wilhelmsburger under which the variety was imported into New Zealand before the war.

Yellow-fleshed Turnips

N.Z. Purple Top Yellow
N.Z. Purple Resistant
N.Z. Green Top Yellow
N.Z. Green Resistant

These varieties remain unchanged and are typical of the rather hard-fleshed, late-maturing, and good-keeping Aberdeen types of pre-war years. In addition, the two Resistant varieties show marked resistance to club-root attack.

N.Z. Waites Eclipse: A purple-topped, yellow-fleshed variety softer in the flesh and generally heavier yielding than the Aberdeen types, but not of such good keeping quality. Growers will recognise in this variety the Waites Eclipse imported before the war.

N.Z. Victory Yellow (previously N.Z. Soft Green Top Yellow): It has been found that the term "soft" included in the name of this variety has given an erroneous impression to farmers. The variety was described in the October, 1949, issue of the "Journal" and compares with pre-war imported varieties classified as Green Top Yellow other than those of the Aberdeen type.

N.Z. Champion Hybrid: This variety, of which Government-approved seed is available for the first time, has a yellow flesh and a green skin above ground level. It is earlier in maturity than the other green-topped yellow-fleshed varieties and is the counterpart of the type marketed before the war under various descriptions incorporating the word hybrid.

White-fleshed Turnips

N.Z. Green Globe
N.Z. Red Globe
N.Z. Purple Globe

No alteration occurs in these varieties.

N.Z. York Globe: This turnip has a white flesh and red skin and produces a small top in relation to the size of the bulb. It is not a particularly heavy cropper, but matures much more rapidly than other varieties. It is useful therefore for sowing late in the season when earlier sowings of other varieties have failed. Its small top makes it suitable also for sowing with grass in autumn.

Germination of Government-approved Brassica Seeds

As Government-approved brassica seeds are not identifiable with the corresponding purity and germination certificates, the Department of Agriculture ensures that the seed of each variety is made up into one blend before making the season's distributions.

The germination of all varieties of Government-approved turnip and swede seeds being distributed in 1951 is over 90 per cent. except for the following:—

	Per cent.
N.Z. Crimson King swede ..	85
N.Z. Sensation swede ..	71



N.Z. Superlative swede.

The latter is the only line of Government-approved Sensation swede available for distribution. It is being marketed at 6d. per pound less than seed of other swede varieties, and the containers are being stamped to show the germination of the seed.

All packets of Government-approved turnip and swede seeds being distributed to retailers this year carry the identification letter T.

Thousand-headed kale seed is the only other Government-approved seed distributed, and the germination of the seed being supplied this year is 91 per cent.

BOOK REVIEW "Servicing and Maintenancing Farm Tractors": E. J. Johnson and A. H. Hollenberg

UNLIKE farm practices and techniques, which vary between countries and climates, the farm tractor as a power plant for the operation of a variety of farm equipment used in crop production is the same the world over. This publication, though prepared by Americans in the light of American experience, will therefore be just as valuable to the New Zealand farmer as the American.

Because the tractor usually represents the largest single investment in mechanised equipment, and because of the hours of continuous operation which it must deliver, the efficient practical farmer gives careful attention to its servicing and maintenance. Experience proves that failure to do so is costly in time, labour, and money.

The authors have prepared this book to assist the farmer with important tractor servicing and maintenance jobs so that maximum efficient service with convenience and economy will be obtained. A tractor out of adjustment, poorly maintained, and improperly serviced is a liability; properly adjusted, well maintained, and well serviced, it continues to be an asset.

The book is so arranged, with step-by-step suggestions about working principles, structural details, and methods of repair and adjustment, that the farmer, as an unspecialised mechanic, whenever having to do a variety of jobs to ensure the availability of the tractor in good working order need have no doubts about being able to perform these jobs satisfactorily.

Each of the 15 chapters deals with a specific section of the tractor and each starts with comparisons of the different systems used by the various manufacturers and gives servicing instructions and hints about snags to avoid and correct procedures.

A special chapter is devoted to operating a tractor safely, and if the precautions in this were observed, the large number of fatalities which occur each year with tractors would be reduced. Other chapters deal with lubrication and storage, the preparation of tractors for winter use, and location of tractor troubles easily.

The book is clearly and concisely written and well illustrated. Because of its clear explanations of first principles it would be of value to the student as well as the farmer interested in the efficient operation of his tractor.

—*H.W.T.E.*

McGraw-Hill Book Co., New York. $3.

New Garden Year Begins in Most Districts in September



By H. P. THOMAS, Vegetable Instructor, Department of Agriculture, Wanganui

SEPTEMBER is regarded in many districts as the beginning of the new gardening year. If the state of the ground and climatic conditions permit, small sowings and plantings of most hardy kinds of vegetables may be made outdoors, but these should be confined in the main to early quick-maturing varieties.

IN most districts frost-tender subjects such as outdoor tomatoes, pumpkins, marrows, melons, and cucumbers should now be sown under glass and the ground where they are to be planted out should be prepared.

Advantage should be taken of fine weather to hoe over cultivated ground that is soon to be planted to free it from weeds and to produce a suitable seed-bed. If there is an area still in green crop, the crop should be dug in now.

Early potatoes should be kept well earthed up to protect them against inclement weather and from damage by late frosts. In districts free from late frosts a planting of main-crop potatoes may be made.

Pea seedlings should be protected from birds and further successive sowings should be made where early-sown crops are well up.

Regular hoeing of growing crops is especially important at this time, because frequent rains often tend to consolidate the surface.

Where soil drainage and temperatures are satisfactory, established crops of cabbage, cauliflower, peas, silver beet, broad beans, and onions will be stimulated by a weekly application of liquid manure. These crops should also be moulded up to provide temporary support against wind and to assist drainage.

Advanced crops such as broad beans should be supported by brushwood, thin stakes, or heavy strings passed around stout stakes on the outsides of rows.

Tubers of Jerusalem artichokes and roots of asparagus and rhubarb should be set out as soon as possible. Leeks not harvested and any other root crops which have been left in the ground over winter should now be removed to avoid regrowth and to enable the ground to be cultivated. Root crops should be used as soon as possible after digging, as crops dug at this time of the year seldom store well.

The planting of tomatoes in unheated houses should be completed early this month.

A few rhubarb plants may be forced by mulching them with organic material and covering the crowns with boxes or other receptacles.

REMINDERS FOR SEPTEMBER

Sow: Asparagus, artichokes (globe), *brussels sprouts, beetroot, broad beans, †runner beans, †dwarf beans, cress, carrots, *cucumber, *cauliflower, cabbage, *celery, *celeriac, *leek, lettuce, *marrow, *melon, mustard, onion (spring), parsley, *pumpkin, parsnip, peas, rhubarb, radish, spinach (summer), silver beet, spinach beet, turnip, salsify, *tomato, and watercress.

* Plant under glass, except in very favourable localities.

† Only in a few of the more favoured northern districts.

Plant: Artichokes (Jerusalem), asparagus (particularly in the South Island), cabbage (summer and autumn), cauliflower (summer and autumn), herbs, lettuce, onion (autumn sown), ‡potatoes, silver beet, spinach beet, rhubarb (without delay), and tomato (complete planting in unheated houses).

‡ In districts free from late frosts.

In September the foundations of the season's vegetable production are laid, particularly in the North Island, and as soon as the soil begins to warm, seeds should be sown and plants ready for transplanting should be set out in their permanent places.

Preparation of Soil

The most important work will therefore be the continued preparation of the soil for seed sowing and transplanting which was described fully in last month's "Journal". However, heavy soils, particularly those in southern districts, should be handled cautiously and worked only when conditions are favourable or much harm is likely to be done.

Small sowings of most of the hardy kinds of vegetables may be made in northern districts, although October is perhaps more widely favoured for general sowings in most South Island districts. In a few of the more favourably situated districts in the north, where late frosts are unlikely, even frost-tender subjects such as runner and dwarf beans, pumpkin, marrow, and cucumber may be sown. In less

Heading photograph by Green and Hahn Photography Ltd.

favourable districts seed of tomato, marrow, pumpkin, melon, cucumber, egg plant, capsicum, celery, celeriac, leeks, brussels sprouts, and cauliflower can be sown under glass for planting out in October.

Where glasshouses are not available cloches or glass frames may be used. Expensive or elaborate structures are not always necessary and the home gardener can often get excellent results with the wise use of sashes against sunny walls or with boxes covered with panes of glass.

The application of a base dressing of a "complete" or "balanced" fertiliser, one containing nitrogen, phosphoric acid, and potash, will be advantageous at this time. If the dressing is applied before sowing is done, it will obviate the necessity for making individual fertiliser applications to each crop at sowing or planting time. Side dressings to suit the needs of various crops can be made later at various stages of their development. Though it should not be applied at the same time as the fertiliser, an application of 2 to 3oz. of lime to the square yard is advised for most vegetable garden soils not recently dressed, especially those in high-rainfall areas.

Hoeing between crops should be done from an early stage in their growth to keep down weeds by disturbing them as soon as or shortly after they germinate.

Advantages of Cloches

The difficulties of producing early and late vegetables in the home garden can be partially overcome by the use of cloches. Cloches have been used for many years overseas and the results indicate that they deserve wider use in home gardens in New Zealand.

The glass protection prevents loss of heat from the soil and for this reason alone cloches are valuable to the early growth of plants and the development and protection of seedlings.

There are several types of cloches; tent and barn types may be purchased in different sizes. The tent pattern consists of two sheets of glass held firmly in position by various methods, such as by sheet metal, wooden blocks, or wire. The barn type is usually made up of 4 sheets of glass held rigid by wires. Most cloches are simple to assemble or dismantle and they can also be moved with ease from one position to another.

The home gardener with some cloches of both the tent and barn types can put them to numerous uses. The medium-size tent style is ideal for raising many kinds of seedlings in spring, and early carrots, beetroot, lettuce, spinach, or even strawberries can be grown under them. Numerous flower and vegetable species can be grown if barn-type cloches are available, and rhubarb or asparagus can be forced under cloches.

Seed of almost all hardy vegetables may be sown in winter, provided the cloches are placed in position 10 to 14 days before sowing to allow soil to warm up. Cloches can be used to start most crops and to mature them.

Rows of cloches are best run north to south. The ends of the rows should be firmly closed with sheets of glass. Where frosts are likely to be severe cloches should be covered with straw or sacking at night.

To give better ventilation in the summer a gap of about ½in. may be left between cloches. Care should be taken to see that all cloches, whatever the type, are firmly anchored in the soil.

Types of tent cloches available vary in size from about 7in. x 18in. x 20in. to about 11in. x 18in. x 18in.; barn types from about 12in. high x 18in. wide x 14in. long to about 24in. high x 24in. wide x 20in. long are obtainable.

Artichokes (Jerusalem)

Jerusalem artichokes may be planted now. An isolated piece of ground is advisable for a planting, as once these artichokes are established they are not easy to eradicate. They are propagated by tubers in much the same way as potatoes, but their annual growth may reach a height of 6ft. or more. They do well in a well-worked, fertile loam, but too much fertiliser, particularly nitrogenous, will produce excessive top growth at the expense of tubers.

Whole or cut tubers may be planted 4 to 6in. deep and 15 to 18in. apart in rows 3ft. apart.

Artichokes are very hardy and are rarely troubled by disease or insect pests. They keep well in the ground and may be dug for use as required.

Asparagus

It is not too late to plant new asparagus beds, particularly in the south, where conditions are often more conducive to growth in September than in August. Planting procedure and subsequent treatment of new beds were described in the May and June issues of the "Journal".

Established beds of asparagus should now be hand weeded, particularly in northern districts where plants in established beds will be starting into growth. Applications of liquid manure at approximately 14-day intervals will be of great benefit at this stage of their growth. Liquid manure made from farmyard or poultry manure is excellent, though nitrate of soda or sulphate of ammonia, 1oz. to 4 gallons of water, may be used as a substitute.

When spears are approximately 6in. long they should be cut with a sharp, long-bladed knife 2 to 3in. below the surface of the soil. Care must be taken during the cutting to see that no young adjoining growths or crown buds are damaged.

Broad Beans

Though broad beans are primarily a cool-weather vegetable, they can still be sown in most districts, but sowing is not advisable on soils that tend to dry out. Broad beans prefer a fairly heavy, well-drained soil that has been thoroughly cultivated and supplied with organic material such as farmyard manure or compost. Lime is essential and if the ground for broad beans is considered to be low in lime content, a dressing of 2 to 4oz. per square yard before sowing is advisable. A side dressing of equal parts of superphosphate and blood and bone may be applied on each side of the rows at ½lb. to each 12ft. of row when the plants are approximately 12in. high. Moulding up of the plants for support and covering of the manure are advisable.

The seed is sown 2in. deep and 6 to 10in. apart in double rows about 10in. apart, with 4ft. between the rows.

Varieties: Broad Windsor, Early Long Pod, and Leviathan Long Pod chiefly are grown in New Zealand, though Coles Dwarf, which grows about 2ft. high, should find favour.

Cabbage and Cauliflower

Seedlings of cabbage and cauliflower sown earlier in boxes, frames, or warm, sheltered positions outdoors should be set out as soon as they have hardened off.

Spraying with Bordeaux or a similar suitable copper fungicide is recommended for the prevention of downy mildew, which is likely to show up in the seedling bed, particularly at this time of year.

September is a good time to sow several varieties of cabbage and cauliflower seed to obtain plants having different maturity periods and thereby provide for a succession of cutting through summer and autumn. Varieties of cabbage such as Golden Acre, Copenhagen Market, and Henderson's Succession will mature successionally if planted about the same time. Similarly cauliflower such as Early London or All Seasons, Phenomenal Early, Phenomenal (5 Months), and Phenomenal Main Crop are examples of a succession that can be obtained with several cauliflower varieties. Information on seed-bed preparation and planting was given in last month's issue of the "Journal".

Carrots

Seed of carrot should be sown as soon as soil conditions are favourable. Several small, successional sowings are preferable to one large one in most home gardens, particularly in northern districts where the carrot rust fly (*Psila rosae*) is troublesome. Serious infestation in these areas can also be minimised by sowing seed for the main crop in October or early November, when the first generation of carrot rust fly has passed and before peak development has been reached by the second generation, usually about Christmas. The crop should be sown as far as practicable from where the previous infected crop was grown or from other susceptible crops such as celery, parsley, or parsnips. The maggot, which damages the roots, is very difficult to control and a repellant such as horticultural naphthalene should be dusted on the foliage and 6in. on each side of rows at the rate of 4oz. to 20ft. of row at intervals of 10 to 14 days to keep away the egg-laying fly.

As the naphthalene is volatile, it should be applied regularly, but application should be stopped several weeks before harvesting, otherwise there may be some residual flavour of naphthalene after carrots are cooked.

Another method found effective is to apply D.D.T. 50 per cent. wettable powder, ½oz. in 4 gallons of water, along the plant rows when plants are about 2in. high and directly after thinning. Further applications should be repeated at monthly intervals and these applications should be sufficient to penetrate the soil to a depth of 3 or 4in.

Carrot Aphis

Where carrot aphis (*Cavariella aegopodii*) infection is a serious handicap to the establishment of carrot crops the

sowing of the main crop is sometimes deferred until late December or January. The aphides, which may be found throughout New Zealand, attack the foliage and can cause the death of the young seedlings.

The aphides can be controlled by regular spraying with nicotine sulphate 1:800 (1fl. oz. to 4 gallons of water) plus 2oz. of soft soap, which should be dissolved in a little hot water first. The leaves of the carrots must be thoroughly covered with spray, and the operation should, where possible, be carried out in the warmest part of the day.

Like most fleshy taprooted crops, carrots do well in a deep, well-drained, and well-cultivated soil that received a liberal dressing of organic material such as stable or farmyard manure for the previous crop. Where the soil is reasonably well supplied with organic matter carrots respond well to moderate dressings of artificial manure. A "complete" fertiliser high in phosphoric acid is likely to give good results on a wide range of soils. Such a fertiliser could be made up of 8 parts of superphosphate, 3 parts of sulphate of ammonia, and 1 part of sulphate or muriate of potash, all by weight. Apply it at 2 to 3oz. per square yard.

Soil for carrots should be worked down to a fine tilth and the seed sown ½in. deep in rows 12 to 15in. apart. If seed has been sown thinly in light soils, thinning of most early varieties may not be necessary. In heavy soils that tend to compact or where large-rooted varieties are grown plants can be thinned to 4in. apart.

Varieties

Popular varieties are:—

Early and short: Early Short Horn, Early Krop, and Early Market.

Half long: Chantenay, Guerande, and Manchester Table.

Long: James' Intermediate and Long Red Altringham.

Celery

Where home gardeners prefer to raise their own celery or celeriac plants an early sowing of seed may be made at the end of September to produce plants for December and January planting. To grow the plants successfully it is essential that the temperature should be maintained at well above 50 degrees F. Early in the season therefore seed should be sown under glass, though later, in favoured districts or warm situations, outdoor sowing is satisfactory. Celeriac is a member of the celery family and has a large, turnip-like root which is the portion of the plant that is eaten. It is an excellent vegetable for flavouring soups or for using fresh in salads. It can also be boiled and sliced and served with white sauce.

Seed should be sown in a good, fine soil and when seedlings are large enough to handle they should be pricked out into seedling boxes 2 to 2½in. each way. The seedlings should be kept in boxes for a fortnight or so and given plenty of ventilation. They should not be put in a position where they will become drawn.

Seedlings are hardened off gradually by being removed first to frames where they may be sheltered and finally to open ground to be exposed to the weather before planting out.

Varieties: Golden Self-blanching and Golden Plume, which are self-blanching varieties, are perhaps the most popular. However, many home gardeners still favour those which require blanching by earthing up or wrapping. Crystal or Solid White is a good representative of this type and is particularly favoured in southern districts.

Frost-tender Vegetables

Sowings of tender plants such as tomatoes, pumpkins, marrows, cucumbers, and melons depend on situation and on whether heated facilities are available. Date of sowing will also depend on the incidence of frost; the recognised safe date for planting out frost-tender plants will vary from mid-October in the north to mid-November in the south.

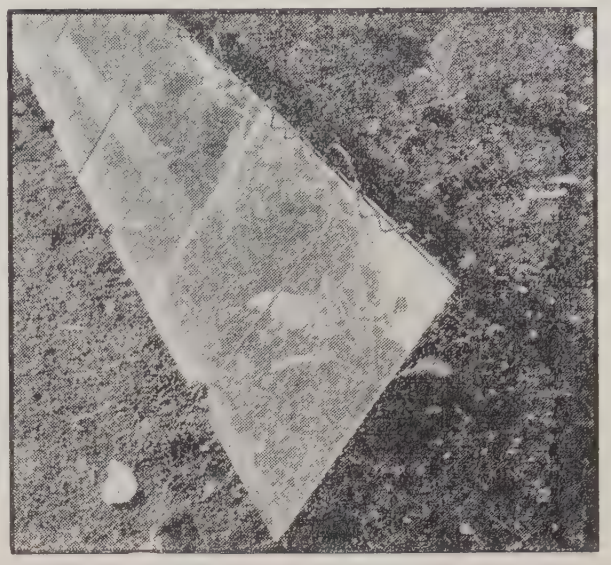
Tomatoes started in warm conditions require about 6 weeks to reach a suitable size for planting out, but a month is usually sufficient for marrows, pumpkins, and cucumbers.

Ground for tomatoes, beans, marrows, pumpkins, and cucumbers should be prepared now. The cucurbits (marrows, pumpkins, cucumbers, etc.) in particular are gross feeders and will respond to a liberal supply of manure and plenty of water.

In a few parts of the North Island where favourable conditions prevail beans, cucumbers, marrows, and pumpkins may be sown outdoors from mid-September, but in most other districts in the north it is advisable to wait until mid- or late October. In the South Island in most districts there is danger of frost until early or mid-November; sowing outdoors should be deferred until at least the end of October unless coverings can be provided. Frost-tender vegetables should not be planted early, particularly if garden space is limited. The home gardener cannot afford to occupy valuable ground and run the risk of getting half a crop, or perhaps of losing it, after weeks of preparation.

Cucurbits

Bush varieties of marrow and pumpkin should be planted 4 to 6ft. apart and the trailing varieties at least 8ft. apart. The hill method is usually adopted for sowing cucurbits and the positions for plants should be marked out before sowing is done. To make a hill a hole approximately 1ft. deep and 2ft. in diameter is made and three parts filled with manure or compost well mixed with some of the surface soil. The remaining 3in. should then be filled in with topsoil.



[*Sparrow Industrial Pictures Ltd. photo.*

Tent-type cloche. The difficulty of producing early and late vegetables in the home garden can be offset greatly by the use of cloches.

If the soil is dry, the prepared spot should be thoroughly watered some hours before sowing; 6 to 8 seeds may be sown round the edges of each hill and these should be thinned to 3 or 4 plants when growth becomes established.

Beans

Dwarf varieties of beans are sown 18in. apart in drills 5 to 6in. wide and 3in. deep. Seeds, which are staggered, are sown 3in. apart in double or treble rows along the drill.

Climbing beans which require support are planted according to the supports used and whether planting is on one or both sides of the support. The seed should be set 3in. deep and 8in. to 1ft. apart.

Tomatoes

Tomato plants should be spaced 18in. apart with at least 30in. between the rows for convenient working.

Staking

After final preparation of the ground has been completed stakes for runner beans and tomatoes may be put in position.

Leeks

Few vegetables are as easily grown and yet as useful as leeks, which, if successively planted, may be obtainable during late autumn, winter, and early spring.

They suffer little from insect pests or diseases, are perfectly hardy in the severest weather, and may be grown to a considerable size without sacrifice of quality.

Though very accommodating as to soil conditions, leeks respond especially well to liberal manuring and watering.

As they require a long growing period, an initial sowing should be made in September. If soil conditions do not appear favourable in some districts for early outdoor sowing, the seed may be sown in a box of prepared soil under glass. A warm position should be selected for the seed-bed.

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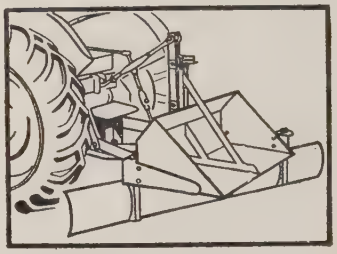
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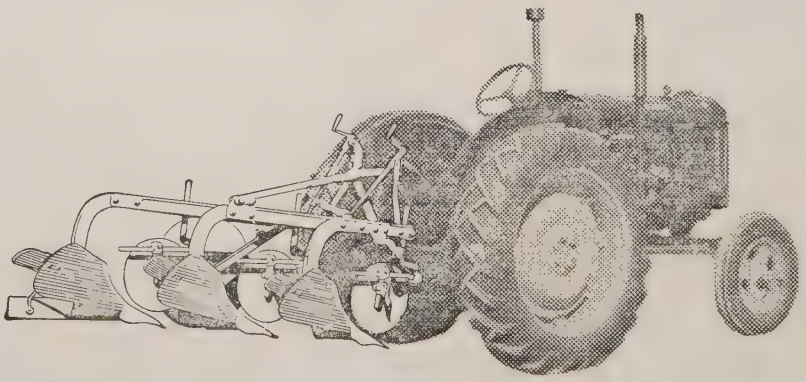
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[*Green and Hahn Photography Ltd. photo.* [*Sparrow Industrial Pictures Ltd. photo.*

Left—Deep box with glass over top and at sides for propagating tomatoes; such boxes can be used for raising other frost-tender vegetables. Right—Old cases, with the bottoms removed, covered with pieces of glass provide excellent protection for tender plants when they are first set out.

which should have been cultivated thoroughly and worked to a fine tilth some time before seed is to be sown. The soil surface should be firmed before the seed is sown—¼in. deep in rows 12in. apart. As the seedlings take a considerable time to grow large enough for transplanting (lead pencil thickness), frequent shallow cultivation will be necessary to assist in aerating the soil and checking weed growth.

Varieties: Popular varieties are Musselburgh, Lyon, and London Flag, the first being considered the best for general use.

Onions

In most South Island districts maincrop onions are sown in September if ground conditions are favourable.

The ground should be well cultivated and manured some time in advance of sowing. Good drainage is essential and although a firm bed is required, the surface should be of a fine tilth to a depth of approximately 1in. to facilitate germination and establishment of the young plants. Light soil can be firmed by treading; raking is usually sufficient for heavier soils. Slow-acting fertilisers are the best if long-keeping bulbs are required.

The following fertilisers per square yard are recommended and if possible should be broadcast 2 to 4 weeks before planting: 4oz. of bonedust, 2oz. of superphosphate, and 1oz. of sulphate or muriate of potash.

Transplanting: In northern districts where it is usual to sow seed in autumn and to transplant in spring September is a suitable month for this work. The preparation of the ground as given for sowing applies also for transplanting young plants.

Parsley

At least two sowings of parsley each year are recommended—one in spring and the other in autumn. For summer and autumn supply seed should be sown now. A dressing of 2 to 3oz. of blood and bone per square yard worked into the soil will be beneficial, although parsley does well in most moist garden soils. Seed should be sown thinly ¼in. deep in rows 12in. apart and plants should be thinned later to 8 to 12in. apart. Parsley seed is slow in germinating, taking from 4 to 6 weeks to come up. Soaking the seed for a few hours in warm water before sowing will be helpful, particularly if the soil tends to be dry.

Do not strip a plant of all its leaves, but remove one or two here and there.

Parsley can be transplanted, but this should be done when plants are young, as older plants develop deep taproots.

Varieties: Moss Curled and Triple Curled.

Peas

It is not perhaps generally known that peas thrive best in cool weather, and for that reason early-spring sowings often give more satisfactory returns. A sowing should be made without delay.

Successional sowings are advisable from September, as time during which each planting can be harvested is limited. Continuity of supply can be maintained either by sowing at about the same time varieties having different maturity periods or by making regular sowings of the same variety.

Peas repay good cultural methods and the ground should be deeply dug and manured, preferably in autumn, with organic material such as farmyard manure, compost, or stack bottom. The soil should then be left in a rough condition to weather over winter. Addition of superphosphate at 2 to 3oz. a square yard is beneficial on many soils.

Peas should be planted in a wide, flat drill 2in. deep, the seed being staggered 2 to 3in. apart each way in three lines. Rows should be spaced 18 to 36in. apart according to the height of the variety.

Black cotton stretched over the rows or wire-netting guards will protect young seedlings from birds. Earthing up in the early stages is desirable to provide some initial support, although staking should be done early.

Varieties

Many good varieties of peas are available and detailed descriptions are given in most seedsmen's catalogues, but those generally suitable for the home gardener are:—

Early: William Massey, Blue Bantam, English Wonder, and William Hurst.

Mid-season: Greenfeast. Dwarf Defiance, Stratagem, and Alderman.

Potatoes

September plantings of potatoes may be made in districts free from late frosts, but in most South Island districts it is not yet safe to make a general planting. Except in favourable situations planting of main crops is best deferred until mid-October.

The soil for potatoes should be deeply and thoroughly cultivated, well-drained, and have an abundance of humus. Organic manure such as farmyard or stable manure is excellent, but should preferably have been applied the previous autumn. Heavy dressings of organic manure are not advisable nor should the soil be heavily limed.

The fertiliser requirements for potatoes depend largely on the organic material previously incorporated in the soil, but in general it has been found that a mixture of 3 parts of superphosphate, 1 part of sulphate of ammonia, and 1 part of potash gives satisfactory results. This mixture can be applied at the rate of from 6 to 12oz. to every 6yds. of row. Alternately equal parts of superphosphate and blood and bone and ¼ part of potash may be used.

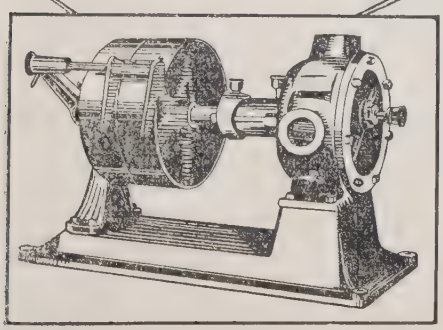
Planting may be done in several ways, although the easiest and most satisfactory one is to open up a trench about 4 to 5in. deep and then dust the recommended fertiliser along it. The fertiliser should be lightly stirred in and the tubers planted 15in. apart in rows at least 30in. apart. Closer plantings may be made with early crops.

Large seed may be cut into two or more sets, provided two eyes are retained on each set. Cut seed should be planted as soon as possible.

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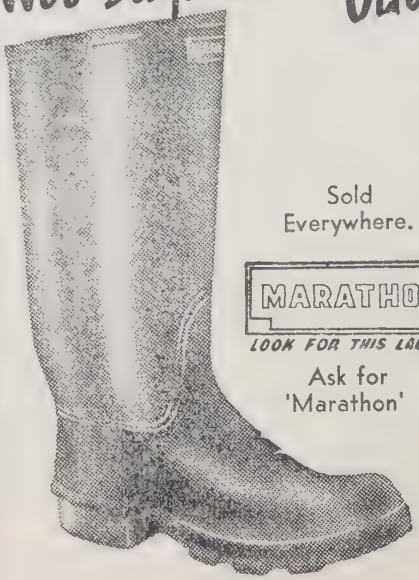
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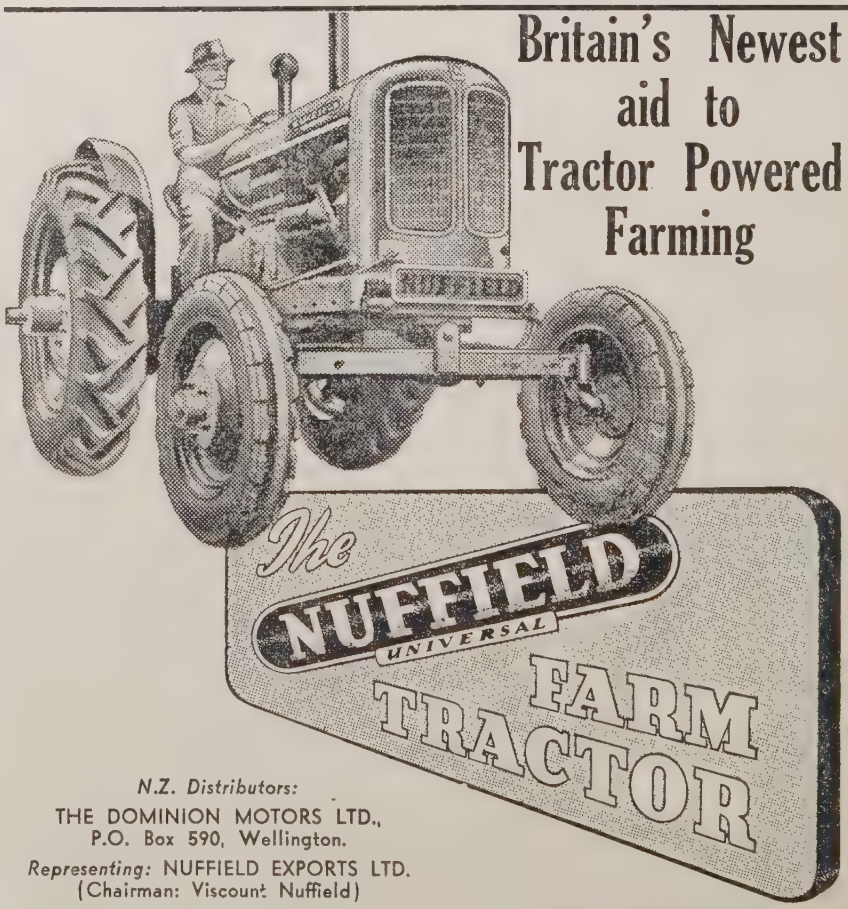


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Where it is preferable to withhold planting at present it is desirable though not essential to put out the seed in a light, airy, frost-free place so that the tubers may green and sprout.

Varieties

It is advisable to choose varieties that have proved suitable for local conditions, but Epicure is perhaps the most favoured early variety, though others such as Doon Early, Jersey Bennes, Black Kidney, and Cliffs Kidney may be well suited to specific localities. Arran Banner, although not a true early variety, if planted as such can be dug almost as soon as Epicure; it has become very popular for early cropping in the home garden.

Salad Vegetables

Initial sowings and plantings of lettuce, radish, spring onions, mustard, and cress may be made in September. None of these salad crops lasts in the best condition for long, and successive sowings should be arranged so that a a new crop is approaching maturity as the old one passes its best; therefore, small sowings are preferable.

Well-drained soils that have been thoroughly cultivated and worked to a fine tilth are suitable for the vegetables mentioned provided they contain plenty of humus, as it is essential that they should not become too consolidated, yet in dry weather should have good moisture-holding capacity.

Lettuce

Imperial 615 lettuce is especially suitable for the cool conditions likely early in the season. Imperial 847 cannot be surpassed for a main crop during the warmer months. Great Lakes, Drumhead, and Webbs Wonderful are also good varieties for the main crop.

Early in the season lettuce can be more successfully transplanted, but during dry summer conditions direct sowing and thinning are found more effective. Blood and bone, a nitrogenous fertiliser, broadcast at the rate of ½lb. per square yard before sowing or planting will assist in stimulating growth. Seed should be sown thinly ¼in. deep in rows 12 to 15in. apart and the plants thinned or transplanted to stand 8 to 12in. apart in the rows.

Radish

For crispness and quality radishes should be grown quickly. They are adversely affected by hot, dry weather and during such periods they will require plenty of water. Seed should be sown thinly every 3 or 4 weeks ¼in. deep in rows 12in. apart.

Good varieties are: Red Turnip and White Turnip (oval shaped), French Breakfast (medium), and White Icicle and Long Scarlet (long).

Spring Onions

For best results spring onions should be sown in soil that has been worked down to a fine, firm tilth and successive sowings should be made. Seed should be sown ½in. deep in rows 12in. apart.

White Lisbon and Odourless are popular varieties.

Mustard and Cress

Mustard and cress are usually grown as spring and autumn salad plants because they prefer moist, fertile soils. As cress takes longer to mature than mustard, it is advisable to sow it about 5 days before the latter so that both will be ready for harvesting about the same time. Mustard and cress are cut, preferably with scissors, in the seed-leaf stage, when they are green and tender and about 2in. high.

They should be ready to cut for salads in 4 to 6 weeks after sowing. Frequent sowings should be made, and though both can be sown in the open border, boxes or pots are very suitable. Seed of both mustard and cress is broadcast fairly thickly.



[*Green and Hahn Photography Ltd. photo.*

Peas should be staked early, using stout stakes and twine (as shown above), brushwood, or wire netting.

Turnips

Turnips should be grown quickly if good-quality roots are desired. A dressing of superphosphate, 1oz. to the square yard, will assist root development of young plants. Seed should be sown thinly ¼in. deep in rows 12 to 15in. apart and young plants later thinned to 4in. apart.

White Stone or White Milan are suitable varieties for early sowings and Golden Ball or Purple Prince for late sowings.

Fertilisers (Organic and Inorganic)

The use of fertilisers (organic and inorganic) in the home garden requires a knowledge of the respective functions of phosphoric acid, nitrogen, and potash and the application of them, otherwise much harm can be done. Unless the correct fertilisers are applied the desired results from a particular crop will not be achieved.

For instance, nitrogen is a leaf builder and promotes growth and therefore is of particular importance to those vegetables grown for their succulent leaves (lettuce, cabbage, silver beet, etc.). Phosphoric acid assists root and fruit formation and early ripening and is therefore of particular importance to crops grown for their seed or fruit (peas, beans, tomatoes, etc.). Potash strengthens plants, promotes quality in fruits, and makes plants more resistant to disease; it is valuable for root and fruit crops (carrot, parsnip, potato, tomato, etc.).

The following are forms in which fertilisers are available:—

Nitrogenous fertilisers: Nitrate of soda, sulphate of ammonia, blood and bone, dried blood, meat meal, and soot.

Phosphatic fertilisers: Standard superphosphate mixture, basic superphosphate, ground rock phosphate, basic slag, steamed bone flour, bonedust, bone meal, and phosphatic guano.

Potassic fertilisers: Sulphate of potash, muriate of potash, kainit, and wood ash.

The following fertilisers contain two or more plant food constituents: Blood and bone (nitrogenous and phosphatic), fish manure (all three, but potash content variable), and Peruvian guano (all three).

Excess quantities of one plant food cannot make good the deficiency of another. Ideal plant development is rarely possible where applications of only one or two of the three main plant foods are made. What are termed complete mixtures (fertilisers containing all three essentials) may be purchased from most seedsmen or mercantile firms.

At the beginning of the growing season home gardeners would be well advised to apply a "complete" fertiliser to the whole garden and confine to side dressings particular recommendations given for growing crops. There should also be a balance between the three principal plant nutrients in the "complete" fertiliser. Home gardeners can make up their own mixture as follows:—

	lb.
Blood and bone	21
Superphosphate	14
Sulphate of ammonia	7
Sulphate (or muriate) of potash	6

Mixing should be thorough and the fertiliser should be applied at approximately 2oz. to the square yard—about 42lb. per 1/16 acre. The soil should be dug and the mixture then raked or lightly forked in. The total amount of the mixture can be reduced or increased proportionately according to the size of the garden, but the relative amounts of each ingredient should remain the same.

Care of Livestock during September

Contributed by the Animal Research Division

CARE OF EWES WITH TWIN LAMBS

FOR the first month or 6 weeks of life a lamb depends almost entirely upon its mother's milk. Ewes are capable of producing more milk than a single lamb can drink in the early part of lactation. Twins, on the other hand, can soon drink all the milk which the ewe can produce. For this reason, ewes with twin lambs should be drafted off and grazed together on good paddocks. Separation is most easily done immediately after lambing.

ROTATIONAL GRAZING OF CALVES

Well-reared cattle at Ruakura outproduced their poorly reared mates by a total of 40lb. of butterfat over the first two lactations, when both groups were well fed from first calving onward. Frequent changes to good clean pasture are essential if calves are to be successfully reared (see these notes in last month's "Journal"). This rotational grazing avoids deaths in winter, eliminates the need for drenching against worms, and produces yearlings 100lb. heavier than those kept in the one paddock for weeks at a time.

CARE OF PIGS

Late-farrowed spring litters should receive special attention, since these will be approaching weaning age. Creep feeding is the secret of obtaining heavy weaners, and best results will be obtained by having a supply of meal and milk always before the litter. Weaned pigs must be well fed, and if meal has been used before weaning, its use should be continued for at least a fortnight to avoid an after-weaning check. The meal ration will be reduced as the skimmed milk supply increases. It is preferable to feed meal to weaners up to half their daily rations and give the milk saved to the store pigs rather than feed meal to the older pigs at this stage. Sows should be hand mated and receive sufficient milk and meal to enable them to regain some of the weight lost during the previous suckling.

VACCINATION AGAINST SCABBY MOUTH

On farms where scabby mouth occurs each new crop of lambs should be vaccinated. This is most conveniently done at marking. If lambs are not protected, they are liable to suffer a severe check, as the disease makes eating very painful. The vaccine gives very good protection if properly used. Care is necessary to keep the needle prong clear of grease. If it becomes blocked, no vaccine is applied and lambs may still be susceptible.

MASTITIS

Mastitis is usually most prevalent in spring. Milk from all quarters should be carefully examined each day in a strip cup. If there is any abnormality in a quarter, treat it without delay, using 3 tubes of penicillin cerate at 24-hour intervals. Prompt treatment at this time of year will greatly reduce loss in production from light or dry quarters.

COCCIDIOSIS IN POULTRY

To prevent coccidiosis in chickens it is necessary to keep them growing steadily. Any check is dangerous. Cleanliness is very important, as the disease spreads through the soiling of food by droppings. If an outbreak occurs, sulphamezathine should be used in the drinking water. Full particulars of dosage may be obtained from the Department of Agriculture's Poultry Instructors.



FEEDING THE MILKING HERD

Autumn-saved pasture is almost equal to high-quality spring pasture as a milk-producing fodder. It should, therefore, be rationed to the milking cows to make it last until the spring feed comes away and hardens up. An electric fence is essential for efficient utilisation, enabling the pasture to be grazed in small breaks. Unless sufficient reserves of this pasture are available for full feeding, the balance should be made up with silage. Make sure enough hay is retained to balance the lush spring growth.

RICKETS IN POULTRY

Chickens reared without access to sunshine are liable to suffer from rickets. This can be prevented by using in the mash an oil with a guaranteed chick-tested vitamin D content of not less than 100 international units per c.c.; 1½ pints of oil should be mixed with every 100lb. of mash.

DAIRY PRODUCE GRADED FOR EXPORT

THE following figures showing quantities of dairy produce graded for export during June and for the 11 months ended June 30, 1951, with comparative figures for the same month and 11-monthly period of 1950, have been compiled by the Dairy Division of the Department of Agriculture from figures supplied by divisional officers at the various grading ports:—

BUTTER

Period	Creamery	Tons Whey	Total	% Inc. or dec.	Total tons in store at end of mth.
June, 1951 ..	545	22	567	—	23,743
June, 1950 ..	740	36	776	—	6,198
Inc. or dec. ..	—195	—14	—209	—26.932	+17,545
For 11 mths. to 30/6/51 ..	149,111	3,026	152,137	—	—
For 11 mths. to 30/6/50 ..	141,175	2,900	144,075	—	—
Inc. or dec. ..	+7,936	+126	+8,062	+5.595	—

CHEESE

Period	White	Tons Coloured	Total	% Inc. or dec.	Total tons in store at end of mth.
June, 1951 ..	1,778	—	1,778	—	19,869
June, 1950 ..	1,386	63	1,449	—	17,654
Inc. or dec. ..	+392	—63	+329	+22.705	+2,215
For 11 mths. to 30/6/51 ..	102,787	1,526	104,313	—	—
For 11 mths. to 30/6/50 ..	78,656	21,572	100,228	—	—
Inc. or dec. ..	+24,131	—20,046	+4,085	+4.075	—

If these figures are converted into butterfat equivalent, there is an increase of 5.234 per cent. in butterfat graded for the 11 months as compared with the corresponding period of the preceding season. It should be noted that the above figures refer only to butter and cheese graded for export, and that owing to diversions which may take place from time to time, they are not necessarily a true indication of production trends.

Crop and Pasture Production

SEASONAL NOTES Contributed by EXTENSION DIVISION

FAVOURABLE spring weather should be taken advantage of to push ahead with the seasonal work of completing the sowing of spring cereals, the preparation of land for green forage and root crops, and of preparing for closing fields for seed, silage, and hay. Fodder crop production for pig feeding and winter supplementary feeding of dairy herds could well be made more use of on North Island dairy farms as a stage in pasture renewal. There are hundreds of thousands of acres of dairy pastures on which the per-acre butterfat production could be increased if old pastures were broken up and the land resown with Certified grass and clover seeds mixtures.

* * *

CROPS FOR PIGS THE pig industry in New Zealand is mainly a sideline of the dairying industry and is dependent on its by-products as the main source of food. The production of this food is, however, seasonal and there is a period from late autumn to early spring when it is insufficient for pig requirements. At present and over the post-war period there has been a marked trend to reduce production of cereal crops and much less of these and their by-products will be available for pigs. Moreover, they have never been available for purchase at lower prices than the same or equivalent foods produced on the dairy farms. In other words, it has always paid to grow crops where pigs are living rather than to purchase food and cart it to pigs.

MAIZE AND SUGAR BEET Though practically all crops are useful for pig feeding (provided protein deficiencies are made up with meat meal or separated milk), maize and sugar beet are probably the two most valuable crops which can be grown on northern dairy farms. Sugar beet has a high feeding value and leaves and roots can be fed immediately after pulling. Seed should be sown at the rate of 5lb. per acre in rows 28in. apart. As soon as the young plants can be seen the crop should be intercultivated and hand hoed to destroy weeds and singled to space the plants. Several intercultivations and hand weedings may be necessary, but after January the crop is usually far enough advanced to look after itself.

* * *

LINEN FLAX WHERE broadcast coulters are available these should be used for the sowing of linen flax in preference to the ordinary coulter, as the better distribution of seed which they give allows a more even development of individual fibres. Trials carried out by the Department with broadcast coulters have given substantial increases in fibre percentages and total crop weights in comparison with ordinary coulters. A common mistake with the broadcast type of coulter is to dip the points. The bottoms of these coulters should travel parallel with the ground, otherwise a narrower row than the coulters are capable of sowing will result. The soil thrown over the front coulter tracks should be completely levelled down when harrowing, thus ensuring an even covering of the seed. When using broadcast coulters the seeding rate should be increased to 110lb. to 120lb. per acre. Depth of sowing is determined largely by the degree of firmness of the soil. Linen flax should be sown from ¾in. to 1in. deep.

* * *

SWEET LUPINS SWEET lupins have proved an alternative crop to rape for lamb fattening. Trials have shown that sweet blue and sweet yellow lupins are equal to rape for lamb fattening and they withstand drought better and do not suffer so severely from attacks by disease or insects. Seed of sweet blue lupins is available, but there are no commercial seed supplies of sweet yellow lupins owing to harvesting difficulties.



Lambs feeding on sweet blue lupins.

* * *

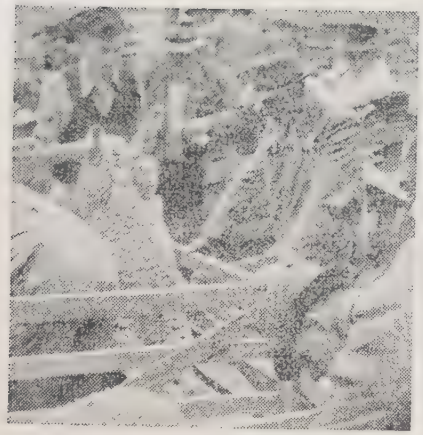
HAY AND SILAGE PASTURES should not be closed for hay and silage until a surplus pasture growth to stock requirements begins to accumulate, otherwise there will be a lowering of production at a very critical stage which may affect production for the rest of the season. Time of closing, though subject to seasonal influences, depends largely on the methods of pasture management adopted. Late closing is usually associated with hard winter grazing over the whole farm, while the practice of winter spelling portions of the farm to allow for the accumulation of feed for late winter and early spring is usually associated with the early closing of fields for silage. Early closing and early harvesting of silage fields allow of a good aftermath growth, which is usually particularly valuable for grazing in late December and January. Though September is the usual closing month for silage and October for hay, less pasture damage results if the closing can be managed earlier and the produce harvested earlier without detriment to the milking herd.

TOPDRESSING Before closing fields for hay or silage they should be harrowed to spread stock droppings and at the same time a watch should be kept for stray pieces of wire and other material liable to stop the mower. The fields should be topdressed at closing unless the intention is to topdress the field immediately after cutting. The latter procedure is preferable if the field is to be cut for silage, for the aftermath growth will then be substantially improved. Fields are usually cut for hay too late to be certain of results from such topdressing.

* * *

VARIEGATED AND CALIFORNIAN THISTLE CONTROL VARIEGATED thistle is very susceptible to the hormone weedkillers of M.C.P. and 2, 4-D acid base. Like many annuals, it is most easily eradicated in the seedling stages, but it can be successfully treated up to flower-head formation. Spray applications are more efficient than dusts or dusts mixed with fertiliser. For complete control with dusts the surface of the plant should be moist at the time of application.

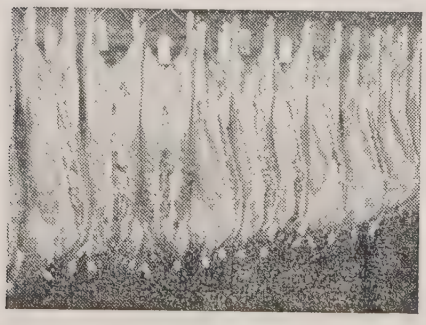
Because Californian thistle is a perennial with an extensive root system as compared with its top growth, it is more difficult to control than variegated thistle. Where the root system of Californian thistle has been broken up by cultivation practices, good control is secured with a single application of M.C.P. or 2, 4-D. On the other hand, for established plants in an old pasture repeat applications are necessary. The first spraying should be made at the time the flowering stalk begins to shoot from the rosettes. Regrowths should be treated the following autumn, with the possibility of a third application being necessary the following spring.



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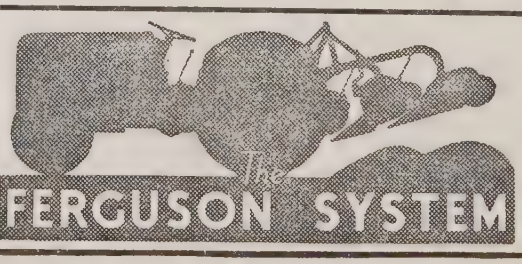
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Effective and Simply Made Bee Escape Board

TO ensure the quick and convenient removal of supers of capped combs from hives during the honey-harvesting period it is necessary first to remove all bees from the supers to be harvested. This can be accomplished in one of three ways: By brushing or shaking the bees from the combs, by using a chemical repellant, with danger of tainting the honey, or by the bee escape boards. The use of bee escape boards is by far the most satisfactory method and is the one most generally used. In this article D. Roberts, Apiary Instructor, Department of Agriculture, Auckland, describes a simple home-made escape board used by Mr. I. G. Muncaster, of Panmure, Auckland.

APIARISTS keeping more than a few colonies of bees will find the use of brushing or shaking in clearing supers too laborious and slow to be of much practical value. This method also entails a great deal of disturbance to colonies at critical periods and unless most carefully carried out is liable to lead to robbing.

Though the fumes from a cloth moistened with a mixture of pure carbolic acid and water are very effective in driving bees out of the supers, the risk of tainting the honey is so great that the use of this chemical as a repellant must be condemned. An efficient chemical repellant which will not introduce undesirable taints into honey has yet to be developed, and beekeepers whose honey is to be marketed for public consumption should realise that the risk of acquiring taint, inherent in the use of chemicals, must constitute a grave threat to maintenance of sales. Honey is a pure, natural food and should not be offered for sale as a foodstuff when its natural qualities are impaired by the presence of foreign flavours. Honey so tainted would be rejected for export.

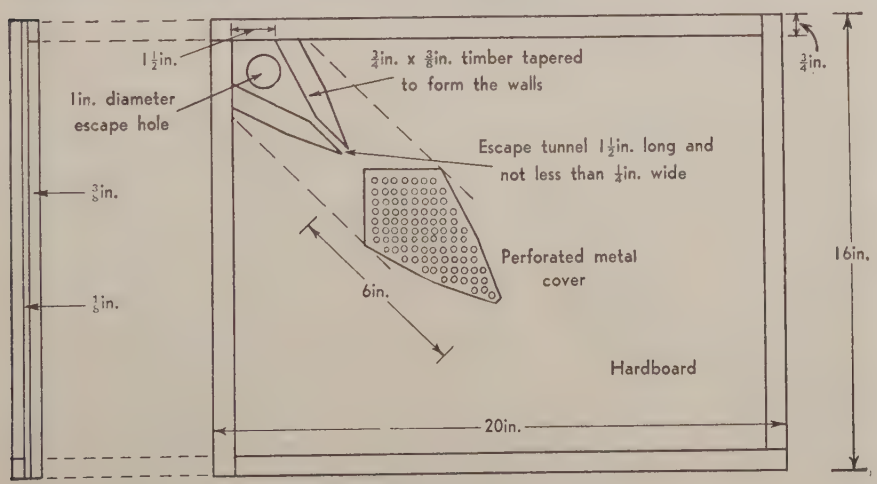
Simple Bee Escape Board

The bee escape board in its various forms is the most satisfactory method yet devised of clearing bees from the supers. The escape used by Mr. Muncaster has proved to be most effective and is simple to make and use. As no springs or other restrictive devices are used in the escape, there is no tendency for blockages to occur and therefore no necessity to use more than one escape vent per board. Experience has shown these boards to be capable of clearing up to 4 supers on a single hive in 24 hours.

As with all other escapes it is of course necessary to ensure that neither the queen nor any brood remains in the supers to be cleaned, otherwise the bees will not leave. Care should be taken when placing the escape in place to see that the exit is not blocked by burr comb built in the super underneath.

Construction of Escape Board

The body of each board is made from a piece of hardboard 16in. x 20in. around the edges of which on both sides of the hardboard is nailed a wooden framework constructed from ¾in. x ⅜in. stock. A 1in.-diameter hole is bored in one corner of the hardboard, the edges of the hole being at least ½in. clear of the frame. Two pieces of wood each 4½in. long x ¾in. wide x ⅜in. thick and tapered to a point at one end are then fixed one on each side of the hole so that the tapered ends come to within not less than ¼in. of each other. This forms the exit for the bees. An ordinary lead pencil will serve very well as a gauge for measuring the exit space. The opposite ends of the tapered pieces should be cut at an angle of approximately 60 degrees to allow a neat fit against the frame. The space formed by the 4½in. strips is then covered with perforated metal and this forms the body of the escape. Providing that the outside edges of the escape boards are well painted the hardboard will last indefinitely.



Details of the bee escape board.

Materials Required

The materials required for each escape board are:—

1 piece of hardboard or similar material 16in. x 20in.

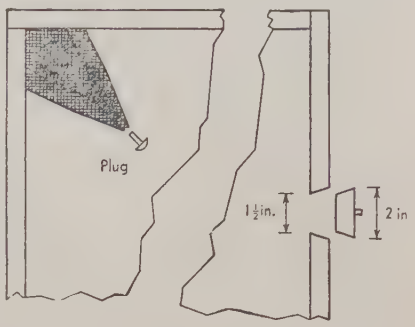
13 lineal feet of ⅜in. x ¾in. timber.

1in. nails, tacks, screw eyes.

1 piece of perforated metal 6in. long x 3½in. wide.

Alternative Use of Escape Board

The cutting of a tapered slot (see next diagram) in the frame of the escape will allow an escape board to



Escape board modified for use as division board.

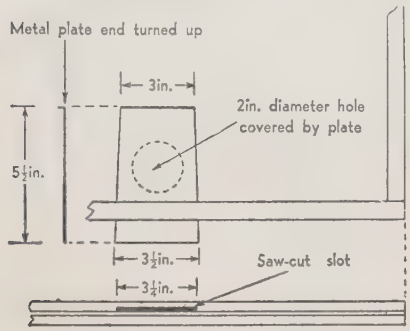
be used as a division board when a hive is being split for requeening, increase, or the adoption of the two-queen system. The tapered piece cut out should not measure less than 1½in. on the inner end and is used as a plug to block the entrance when the board is again used as an escape board. To prevent loss of the plug when using the board for division purposes small screw eyes should be fixed in the end of the plug and in the edge of the frame respectively and the ends of a piece of string or frame wire attached to each screw eye.

When the board is used as a division board the exit of the escape should be blocked with a small plug and a piece of wire gauze fixed with drawing pins over the entrance hole. This will prevent the queens making contact and possibly damaging one another. The 1in. gauze-covered hole will enable both colonies to attain the same odour and will thus assist toward successful uniting. Weak upper colonies will also benefit by the warmth of the colony underneath, which will rise through the screened entrance hole.

Further Modification

A further modification which can be made easily during construction of the board is the drilling of a 2in.-diameter hole, which should be not more than ¼in. out from the inner edge of the frame and midway in the longer (20in.) side. A piece 3½in. long and 1/16in. deep is cut out of that section of the frame which will be placed alongside the hole to form an entrance. A strip of sheet metal 5½in. long tapering from 3½in. to 3in. wide is then cut. When the board is assembled the piece of sheet metal, with the 3in.-wide end inward, is inserted in the slot formed

by the cut in the frame. The metal then forms a sliding cover for the hole which can be opened and closed at will without disturbing the bees. When the metal slide is fitted the inner end



should be bent upward about ⅛in. This will prevent the slide from falling out and being lost when in the open position. The wedging action provided by the tapered form of the slide will keep it secure when closed. So modified, the board is a very useful adjunct when it is desired to return wet extracting combs to the hives for cleaning up.

Cleaning Procedure

The procedure adopted by Mr. Muncaster for cleaning combs is to place a queen excluder over the top super of the hives to be used, which should be strong colonies at least two storeys high. The escape board with the slide fully closed is then placed immediately on top of the excluder and the supers of wet combs stacked on top. The lid is replaced and the slide opened to its full extent. One week has been found sufficient for the cleaning of up to 4 supers of wet combs. When the combs are clear the slide is closed. The bees in the supers will then use the escape to join the colony below. Twenty-four hours is generally sufficient for full clearance of the bees from the supers, but if the work is being done late in the season, when there is little or no brood, up to 3 days may be necessary, as the bees are then sometimes very slow to leave. With this method there is little disturbance to the apiary when the combs are put out and the storing of patches of honey in the empty combs is reduced to a minimum.

Pigeon-pox and Fowl-pox Vaccines

Pigeon-pox and fowl-pox vaccines have hitherto been available from the Department of Agriculture Animal Research Station, Wallaceville. A charge has been made by the Department for pigeon-pox vaccine, which was imported from the United Kingdom, but the fowl-pox vaccine was distributed free. The latter was prepared at the Animal Research Station and has been issued for use by Departmental officers for a period during which field trials have been carried out to test the efficiency of this vaccine.

At the request of the Department the Trentham Veterinary Laboratory Ltd., P.O. Box 29, Upper Hutt (telegrams, "Biovax", Upper Hutt), has undertaken to prepare and distribute both of these vaccines to poultry producers.

Information about the method to be used for fowl-pox vaccination, the class of stock to vaccinate, and precautions which must be taken were given in an article in the "Journal" for June. A poultry farmer who is in doubt whether he should use fowl-pox vaccine should consult the local Poultry Instructor or write to the Veterinarian (Poultry), Department of Agriculture, Box 3004, Wellington.

Farm-made Carriage for Milk Cans



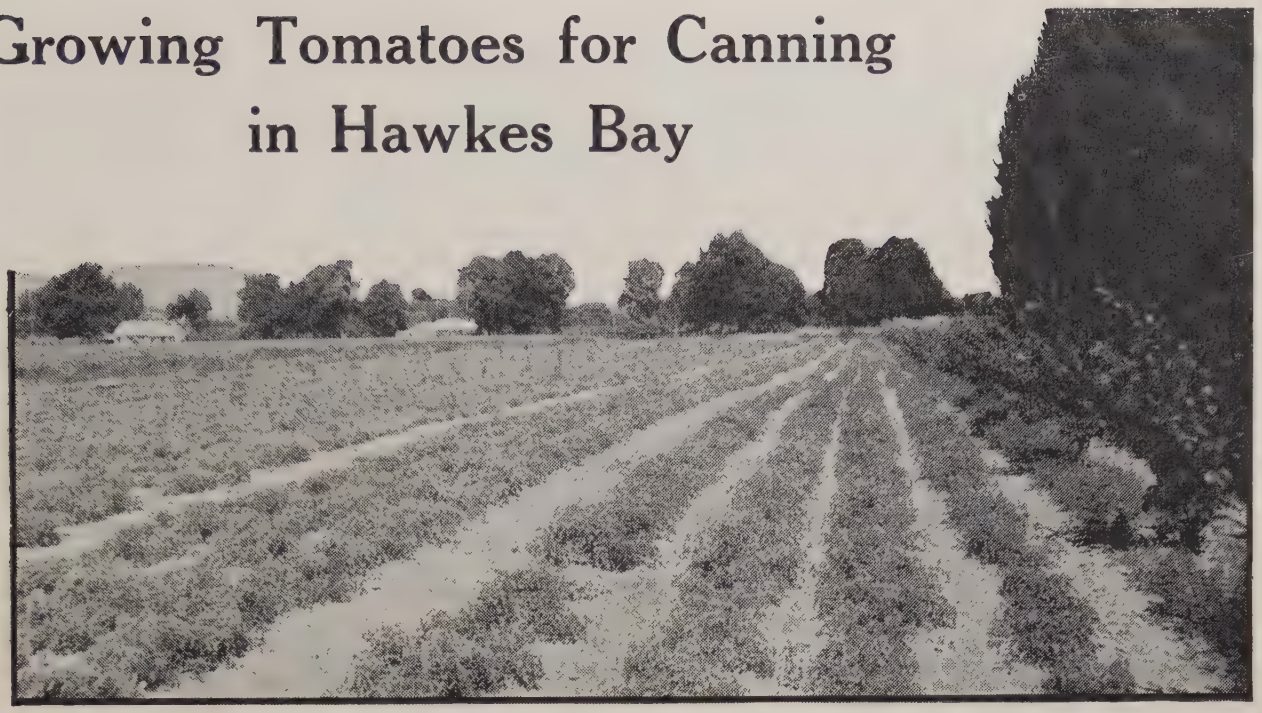
[Sparrow Industrial Pictures Ltd. photos.

AFTER he had ricked his back trying to man-handle heavy milk cans Mr. A. J. Riley, Horsham Downs, Waikato, spent his convalescence in his workshop making the carriage illustrated from a pair of second-hand bicycle wheels, ½in. and ¾in. piping, and a few planks. The bottom of the platform clears the ground by about 4in., so there are no high lifts on to it. The carriage shown was made for four 15-gallon cans; for 20-gallon cans the vertical pipes could be extended 4in. With its low centre of gravity and perfect balance the carriage loaded with four full cans can be handled easily, and bringing in the empty cans from the gate is equivalent to child's play. Mr. Riley finds six concrete posts or two bags of fowl feed an easily managed load. The design could be improved for the carriage of heavier loads by the use of rubber-tyred wheelbarrow wheels in place of the bicycle wheels.

METEOROLOGICAL RECORDS FOR JUNE

Station	Height of station above M.S.L. (ft.)	Air temperatures in degrees (Fahrenheit)				Rainfall in inches					Bright sunshine hours
		Approx. mean	Difference from normal	Absolute maximum and minimum		Total fall	No. of days of rain	Difference from normal	Maximum fall		
				Maximum	Minimum				Amount	Date	
Kerikeri	201	50.1	— 1.8	67.0	30.1	9.02	18		3.17	10	109.5
Auckland	160	51.5	— 1.8	66.5	31.9	3.53	14	— 1.89	1.50	10	140.1
Tauranga	10	48.2	— 1.5	65.0	29.7	4.15	9	— 1.19	2.98	10	151.1
Ruakura	131	44.9	— 2.6	64.3	23.1	2.22	11	— 2.59	0.82	10	135.2
Rotorua	969	44.6	— 1.2	65.2	27.8	3.02	6	— 3.36	1.69	10	142.9
Gisborne	12	47.4	— 1.6	60.6	31.2	2.10	17	— 1.91	0.52	22	102.0
New Plymouth ..	160	48.5	— 1.5	60.2	33.5	2.49	13	— 3.61	0.93	17	145.6
Napier	5	47.2	— 1.2	64.1	29.2	1.89	11	— 1.15	0.86	23	149.1
Kariol	2125	40.7	+ 0.2	62.0	23.0	2.31	10	— 2.46	0.50	17	
Wanganui	72	45.9	— 2.4	67.2	29.3	2.33	10	— 0.97	0.69	17	125.6
Palmerston North .	110	44.8	— 1.9	66.8	27.3	1.92	13	— 1.58	0.50	10	122.7
Waingawa	350	43.6	— 2.0	65.0	25.5	2.53	17	— 1.08	0.72	10	117.6
Wellington ..	415	45.8	— 2.1	58.3	34.2	2.48	13	— 1.85	0.41	16	102.4
Nelson	24	45.0	— 1.2	60.4	29.7	1.33	6	— 2.16	0.42	10	173.5
Blenheim	12	42.8	— 2.6	61.0	24.9	1.33	5	— 1.08	0.51	10	178.1
Hokitika	12	42.8	— 1.8	57.7	25.9	3.19	11	— 5.96	1.40	15	151.7
Hanmer Springs ..	1225	34.6	— 5.2	54.0	15.0	2.36	10	— 1.09	0.49	11	102.6
Christchurch ..	22	40.1	— 3.1	57.6	25.2	2.18	12	— 0.36	0.40	20	139.9
Ashburton	323	39.6	— 1.6	56.4	23.0	1.34	10	— 1.13	0.50	20	148.0
Timaru	56	39.1	— 3.3	57.0	24.6	0.64	6	— 1.15	0.23	16	154.9
Alexandra	520	34.7	— 3.1	52.0	21.9	0.49	4	— 0.27	0.30	15	120.4
Taieri	80	40.0	— 1.8	57.9	25.0	2.19	12	— 0.05	0.92	15	98.7
Invercargill ..	32	40.7	— 1.5	54.0	25.0	2.90	15	— 0.85	0.46	19	74.9

Growing Tomatoes for Canning in Hawkes Bay



TOMATOES require a warm and sunny climate with a long dry autumn for ripening and harvesting of the crop. Hastings, in the centre of the tomato-growing area of Hawkes Bay, ranks high in the Dominion for average hours of sunshine. The climate and fertile soil of Hawkes Bay provide ideal conditions for outdoor tomato growing and in this article by R. I. June, Orchard Instructor, Department of Agriculture, Hastings, the growing of dwarf tomatoes for canning is described.

MOST of the canning tomatoes produced in Hawkes Bay are grown close to Hastings and Napier. Bay View and other warmer parts of the district also produce some tomatoes for processing, but mainly early tomatoes for the markets.

Yields vary considerably according to locality. In the heavier land of the Heretaunga Plains crops of 25 tons or more per acre are common. However, because of lower yields on lighter soil and adverse weather conditions that sometimes prevail, it is doubtful if the average yield per acre exceeds 13 tons.

Frost Damage

Late-spring and early-autumn frosts which sometimes damage young plants or terminate ripening of fruit prematurely bring the average down. Dry conditions sometimes prevail, too, but damage by hail in February such as was experienced in the 1950 season had never been experienced before. About 75 acres were damaged by hail; some crops were ruined, but a good deal of the area still produced 8 or 9 tons per acre. Sometimes wet and cold weather during the growing season checks growth and causes development of disease. Despite a climate which is generally sunny and warm, Hawkes Bay may experience unfavourable conditions, especially for a soft plant like the tomato.

In the 1949-50 season about 85 growers were supplying tomatoes to canning factories in Hawkes Bay. The acreage involved was over 400 and the tonnage about 4500

Varieties

Dwarf tomatoes are grown for practically all canning supplies. Tall or "tie-up" varieties are grown in the district, but these are used chiefly to supply market requirements. One of the favourite dwarf varieties grown a few years ago was Adelaide. The variety cropped well, but the fruit was rough and suitable for canning only. Another Australian dwarf variety, Tatura, became popular three or four years ago, but this has now been replaced largely by Tatinter.

Both Tatura and Tatinter are smooth and of good colour. The latter is firmer and not as susceptible to cracking as Tatura, but is perhaps a little slower in ripening. If the Tatinter variety is not planted too closely, allowing plants to spread and open to the sun, it is quite satisfactory. Pearl Harbour, another semi-dwarf variety, tried in 1950, appears to be subject to cracking and is not likely to become popular in the district.

Raising Seedlings

Hawkes Bay tomato growers have relied almost entirely on local nurseries for their plants, and a number of nurserymen raise tomato plants only. However, the cost of plants has risen steadily for several years and some growers are now considering raising their own seedlings to increase their profits. Some have already done this.

With seedlings costing about £4 5s. per 1000 plus delivery charges a tomato grower cultivating a large acreage would be well advised to raise his own plants.

If proper care is taken, the tomato grower should be able to raise plants as good as or better than those raised by nurserymen, particularly properly hardened-off plants. It is not always possible for a nurseryman raising hundreds of thousands of plants to harden off plants as thoroughly as he would like. Unhardened plants receive a severe check when planted out, unless ideal conditions prevail at planting time, and they often develop a blue appearance and fail to make any growth for some time afterward.

Frames, such as those illustrated on page 109, are essential for producing and hardening off plants. Sliding glass frames allow for good air circulation, but scrim can be used for protection once the plants have been pricked out and are well developed.

Preparation of Soil

It is not good practice to grow a crop of tomatoes too long in one area. A reduction of crop is usually noticeable each year despite the best treatment. Four successive crops are sometimes grown on good land out of grass, but this practice is not recommended. A crop-rotation system should be followed so that tomatoes are not grown in the one place more than 2 years in succession. Many Hawkes Bay crops which have been grown twice or more often on the same area have been satisfactory when the land previously has been in grass. Under these conditions two succeeding crops are not in

---

HEADING PHOTOGRAPH: Fertile soil and a sunny climate make conditions in Hawkes Bay most favourable for the growing of outdoor tomatoes. R. W. Orr photo.

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any way a risk if the first crop has been free from disease.

Much of the canning supply is produced by growers other than market gardeners. Farmers and orchardists grow them as a sideline. Farmers use grassland if possible, crop for 1 or 2 years, and then return the land to grass. They then move to a fresh piece of grassland. In this way they often get their old grassland renewed without loss of revenue.

If the land has been in grass or cover crop, it is ploughed during winter and deeply disced up before final preparation before planting or it is disced well during winter and then ploughed. Discing followed by ploughing is recommended, as the green crop is incorporated in the topsoil before being turned under to rot. Land can then be disced again in spring before final breaking down and levelling with tine harrows before planting.

Bare land is often ploughed in winter and left open to the weather for some time. It is then disced and worked down to a fine tilth for planting. Care should be taken to do the initial discing when the land is still moist enough to break up well; otherwise the fine tilth so necessary for planting will not be obtained. Instead, the soil may remain lumpy, making planting difficult, and losses of young plants will be high, unless there is rain shortly after planting.

Fertilisers Used

Little or no manure is used on the better type of land if it has been under good grass or clover for some years. Manurial programmes vary considerably among growers according to types of soil or previous crops. Too much nitrogen is to be avoided, as fruit tends to be slow in ripening where growth is heavy and rank due to too liberal supply of this fertiliser. Superphosphate is often incorporated at planting time together with a nitrogenous fertiliser. Applications of dried blood or blood and bone at the rate of 5cwt. to the acre or more plus 2cwt. of superphosphate per acre are common. Some growers also claim that they get better-quality fruit through using potash. Possibly more of this type of fertiliser could with advantage be used in Hawkes Bay.

Side dressings of fertiliser later in the season are not used in Hawkes Bay as they are in some districts. Most of the soil in the Hawkes Bay area is fertile and the one fertiliser application carries the plant through and ripens the crop. In some seasons side dressings applied later would no doubt be beneficial.



[*Jack Welsh and Sons photo.*

Cold frames for raising and hardening off tomato seedlings. Glass frames are made to slide both ways to obtain air circulation and temperature control.

Planting

Planting is a very important operation and much of the success of the crop can depend on it. A large percentage of the planting is now being done by mechanical planters. If the soil is in good condition, these machines are very satisfactory, and if operated by experienced men, will plant up to 18,000 plants in an 8-hour day. Four men, one on the tractor, two on the planter, and one man placing the boxes of plants in position at the ends of rows are usually required when mechanical planting is done.

There are various types of mechanical planters, some superior to others. It is essential that the plants should be placed firmly and fairly deep in the bottom of shallow furrows. Plants should not be on exposed ridges, where they tend to dry out. When a finished area is viewed across the rows the plants should be barely noticeable. The tender seedlings if planted as recommended are protected from drying or cold winds and are assured of a moist rooting medium. If furrows are fairly wide, dry topsoil will not fall back and settle around the tomato roots, causing them to dry out.

Very high percentages of successful establishment are obtained with mechanical planters and much time can be saved by their use. A perfect tilth is required for best results. Planting by hand is still preferred by some, who claim that individual attention to each plant is well repaid in the long run. From observations very little difference can be seen in results from the two methods if care is taken in the first place.

A common method of planting is to strike out a furrow, throwing the soil both ways.

The furrow should be wide, so that only moist soil falls back, leaving the best conditions for planting.

In the illustration on page 111 a trailer is pulled behind the ridger. One man can drop the plants accurately in place by walking behind the trailer and four or five men can then plant them and firm them down by opening up a place with a trowel and firming the plants down with the feet. Seven men can plant up to 12,000 seedlings a day and establishment of all plants should be assured if plants and soil are in good condition.

The distance between rows varies a little according to cultivating and spraying equipment; from 5 to 6ft. is usual. The distance between plants in the rows will vary with variety and soil. Some growers will plant as close as 1ft. 6in. apart; others allow 3ft. or more between plants. The Tatinter variety should not be planted less than 2ft. 6in. apart or ripening will be impeded. On rich soil it is better to have rows 6ft. apart and plants 3ft. apart, which still gives approximately 2420 plants per acre. The spacings recommended assure more open-plants and



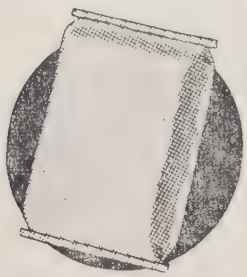
[*Jack Welsh and Sons photo.*

Tomato seedlings ready for planting.

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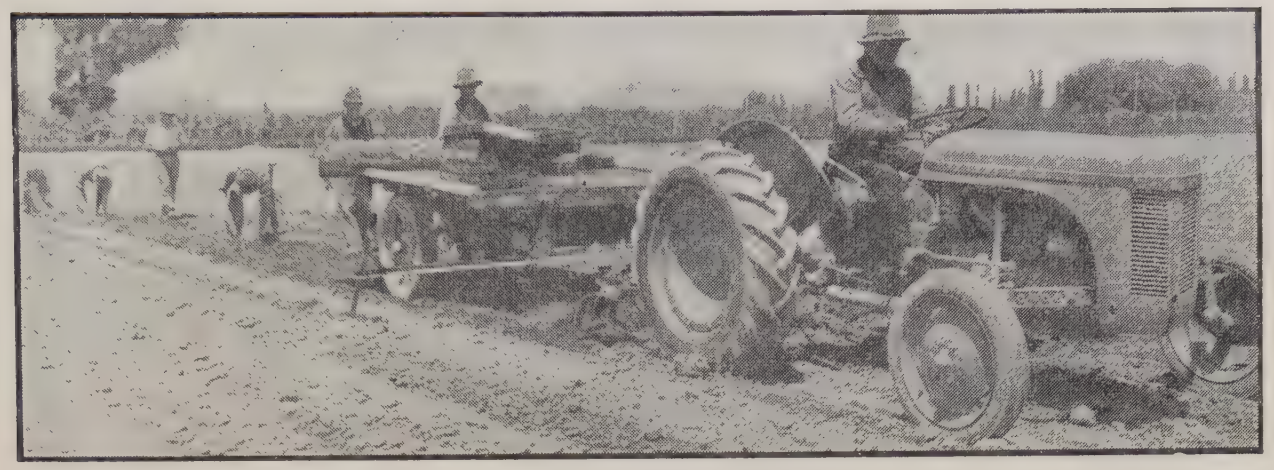
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This team of seven men can plant up to 12,000 seedlings in an 8-hour day. [*R. W. Orr photo.*

better ripening, and may produce a better tonnage than closer planting, which makes ripening too slow to mature all the fruit before picking has to cease.

Planting begins from late October to mid-November. Planting after November 20 is considered too late. It is found that tomatoes planted in October often receive a check due to cold weather, while those planted during the second week of November usually go ahead without such a severe setback and mature as quickly as those set out 2 or 3 weeks earlier. It is sometimes necessary to water the later plantings, but watering of plants set in a wide furrow as described previously is seldom necessary.

Cultivation

Cultivation at frequent intervals is necessary to control weeds. If planting has been done carefully so that the rows are straight and evenly spaced, there is little need for hand-hoeing. Inter-row cultivators with parallel tool bars can be adjusted to work very close to the plants without damaging them. Deep cultivation is not necessary at any time, particularly near the plants, where the roots may become damaged. Spraying and cultivation may be done in one operation.

Spraying Important

Spraying is necessary from the seedbox stage to harvesting. Adequate control of pests and diseases can be assured by spraying at fortnightly intervals, but to keep a protective cover on the plants and thus cover new leaves and stems spraying must be continued. If the weather is adverse, an extra spray may be a good investment.

Bordeaux mixture at the strength of 3:4:50 (3lb. of copper sulphate and 4lb. of hydrated lime to 50 gallons of water) is the usual spray for the control of fungous diseases. Arsenate of lead at 2 to 3lb. to 100 gallons of water is used to control insect pests. D.D.T. has been used in place of lead arsenate, but has not proved entirely satisfactory. In 1950 D.D.D. (a similar type of compound to D.D.T., but one which is not as toxic to humans as D.D.T.) came on the market and was used fairly extensively in the district with good results. D.D.D. does not have the stunting effect on tomato plants often attributed to D.D.T. D.D.D. is used at the rate of 1lb. of 25 per cent. wettable powder to 100 gallons of water, which is ¼lb. of the active ingredient per 100 gallons.

There are also substitutes for Bordeaux mixture. These are copper compound sprays in powder form which can be prepared for use quickly and simply. It is claimed that these prepared copper sprays are not as severe on tomato foliage as Bordeaux. The recommended strength of these sprays is 4 to 5lb. to 100 gallons of water. They can be mixed with lead arsenate or D.D.D.



[*Sparrow Industrial Pictures Ltd. photo.*
Tomatoes are picked into 4-gallon tins, which are emptied into factory cases placed at convenient spaces throughout the crop.

Small areas of young tomatoes can be sprayed fairly satisfactorily with a knapsack sprayer, but for commercial areas a power sprayer with high-pressure delivery is required to assure thorough penetration and complete coverage. Tractor-drawn power spray outfits with boom attachments are usually employed, but orchard sprayers fitted with a boom or simply with a multi-nozzle broom normally used for spraying fruit trees have been used. The fixed boom assures thorough coverage if the boom is properly adjusted and the outfit is driven at the correct speed to give adequate volume. The amount of spray per acre required increases as the plants grow; approximately 50 to 60 gallons per acre are needed for the first application, the quantity being increased at each stage and reaching 200 gallons or more when plants are mature.

Pests and Diseases

Though tomatoes are subject to many diseases and pests, most of them can be prevented or kept under control by maintaining a protective spray cover. This does not apply to virus diseases, two of which are fairly common. Soil-borne diseases are also difficult to control.

Spotted Wilt

Spotted wilt, commonly called "bronzetop" because of the bronze appearance of the growing point, is the most serious virus disease of outdoor tomatoes. As the first symptoms are easily missed, close observation while weeding and spraying is necessary. Small pinpoint, dark spots on the new shoots and leaves appear first, followed by stunting and curling of the foliage. As the disease develops bronze markings appear and little growth is made. The fruit if allowed to ripen shows yellow concentric markings. Affected plants should be removed and destroyed as soon as they are observed. The disease cannot be controlled directly by spraying, but indirect, partial control is obtained by destroying insects which are partly responsible for spread of the virus. A large range of host plants includes tobacco, peas, and lettuce, weeds such as thornapple and nightshade, and many garden flowers.



[*R. W. Orr photo.*

Packing cases of tomato products in a Hastings factory.

Late Blight

Late blight (*Phytophthora infestans*) is a fungous disease which commonly attacks potatoes and can be the most severe disease of tomatoes if left uncontrolled. Although it is known commonly as late blight, it often attacks the tomato plants in the seedling boxes after plants have been pricked out or plants at any stage in the field. Symptoms first appear as dark, water-soaked patches on leaves and stems. In wet weather the patches increase, producing a downy growth similar to mildew on the undersides of leaves, which later turn black. Late blight spreads very quickly in wet or humid weather, particularly if the temperature is warm, but ceases to develop when the temperature rises above 80 degrees F.

As the fungus is carried over in the soil or on dead plants, infected plants should be carefully removed and destroyed. Bordeaux spray will give protection if applied from the seedling stage onward.

Mosaic

Mosaic is a virus disease and affected plants should be rogued when first observed. The disease is not as serious as spotted wilt, but growers should watch carefully for affected plants to prevent its spread. The virus shows as a light green or yellow mottling of the foliage and sometimes as distortion of leaves. Fruit may show blotchy irregularities in the red colouring. It can be spread by hand from one plant to another in pruning. A source of contamination is infected tobacco, and smokers can convey the virus to plants they touch. Smokers should wash their hands thoroughly before handling plants while planting or pruning is being done.

Verticillium Wilt

Verticillium wilt, a soil-borne fungous disease, has given considerable trouble in Hawkes Bay when plants are weakened by a check in growth due to cold wet conditions. High temperatures retard the development of the disease. The fungus enters the roots and travels up the stems, which show a reddish-brown discoloration if cut lengthwise.

The first symptom of the disease is the wilting of leaves. This wilting may show only in the warmth of the day and plants may recover at night. Basal leaves wither and drop and the top growth looks dull if the disease becomes severe. It may affect the whole plant or only part of it. Defoliation of plants exposes fruit to the sun and often results in severe sunscald and further loss of crop.

Very little direct control can be given. A cure is to sterilise the soil, but this is impracticable in a field crop. Crop rotation should be given careful consideration. Potatoes and weeds, including black nightshade and fat-hen, contract the disease. It is important to keep weeds under control and not to plant potatoes or tomatoes too often in the one place. The fungus will remain in the soil for many years. It has attacked peaches, plums, and apricots where tomatoes have been grown or where tomatoes have been used for inter-cropping while orchards are being established. All affected tomato plants should be removed completely with their roots and burnt. Seedlings should be grown in sterilised soil.

Blossom End Rot

Wide fluctuation in moisture is the cause of blossom end rot, which is not a disease but a physiological condition. Moisture fluctuations cause cells at the blossom end of the fruit to break down. Excessive use of nitrogenous manures will aggravate the trouble. It appears first as a small spot on the blossom end of the fruit, giving it a bruised or water-soaked appearance. This area develops and dries out, becoming dark, firm, and flattened. Fruit only is affected and the trouble can be obviated by giving an even supply of moisture. The trouble is not serious in Hawkes Bay, but appears in certain localities in some seasons.

Insect Pests

Tomato stem borer (*Gnorimoschema plaesiosoma*) and **tomato worm** (*Heliothis armigera*) are the chief insect pests in Hawkes Bay. The tomato stem borer can cause considerable loss of young plants, and for that reason insecticides have to be included in the early sprays. Moths lay their eggs on the plants and the young caterpillars hatch out and burrow into the stems of the tomato plants, causing them to collapse.

The tomato worm is a very common pest of the garden. It does not always have the same colour, but varies from light green to brown. In some localities it may have red or yellow markings. The same control as for stem borer is required, except that sprays of arsenate of lead may have to be continued until near the harvesting period.

Harvesting

The date of harvesting varies according to locality, variety, and time of planting. The factory usually receives its first fruit in early February. The length of the picking season varies according to climatic conditions; in seasons when there are no severe frosts the factory may carry on until about April 15 or 20. After this tomatoes are unsatisfactory in flavour and colour for processing.

Tomatoes are delivered in cases provided by the factory. The cases are solidly built and hold about 50lb. of fruit and average 45 cases to the ton.

Most harvesting is done by contract. The picking rate has now reached 10d. to 1s. per factory case, the latter price being paid in the 1950 season, when slow picking was caused by hail damage. Some women are able to pick 50 to 60 cases in 8 hours in the flush of the season and some over 80. Where crops are fairly good it is not difficult to pick 30 cases a day.

The first picking is poor, but subsequent pickings improve as more fruit ripens. Picking is done about once a week in mid-season or less often according to weather and growth of plants. If plants are too vigorous or planted too closely, ripening is often delayed and picking is slow.

The factory cases are usually distributed from either side of a truck driven down every twelfth row. Four-gallon tins fitted with handles are used for picking and are carried to the row of cases when full. Six rows on either side of the rows of cases are picked, which is convenient for pickers and seems the most satisfactory method. This system also assures that the least damage possible is done to fruiting plants.

Tomato Products

There is a wide range of tinned tomato products; Hawkes Bay factories use them for soups, puree, tomato sauce, beans and tomato sauce, and spaghetti. They are also pulped and distributed to other factories, where the pulp is used in the preparation of various products.

No factory figures of quantities of the various tomato products are available. However, with often over 100 tons per day of raw material coming into the factories in mid-season, and with processing going on night and day, the 5000 to 6000 tons of raw material must be converted into hundreds of thousands of tins of various products each year. Tinned products are not only distributed within New Zealand, but are exported in considerable quantities.

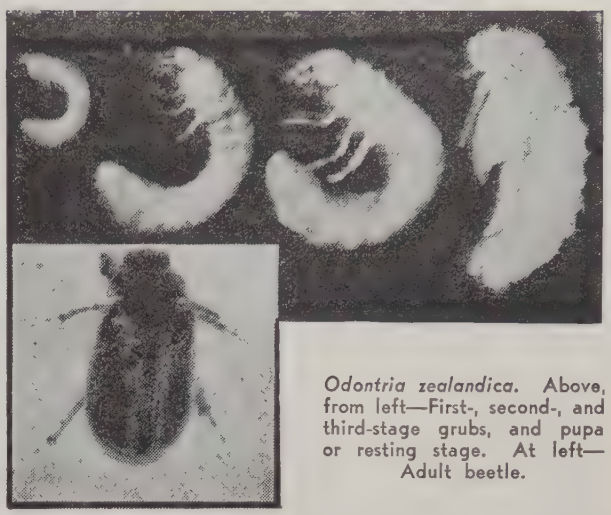
A substantial labour force is employed in producing, transporting, processing, and packing tomato products in Hawkes Bay and workers are obtained from other districts to supplement the labour available locally.

Grass-grub and Grass Caterpillar Control

By J. M. KELSEY, Entomological Research Station,
Department of Scientific and Industrial Research

GRASS-GRUBS continue to cause severe damage to pastures grown on lighter soils throughout New Zealand, and last year were particularly destructive in the Te Miro, Whitehall, and Arohena districts in the Waikato. In view of recent work on grass-grub control it has been considered advisable to make a revision of knowledge of the habits of, and control measures against, this destructive insect. This article, the second part of which will appear in next month's "Journal", also includes an up-to-date summary of the most promising control methods against the subterranean grass caterpillar (*Oxycanus*), or porina as it is usually called by farmers.

THERE are signs that the subterranean grass caterpillar population is increasing, and this has resulted in a search for more effective means of control; the results of tests will be given in the second part of this article. The two pests will be dealt with separately, as farmers often confuse them; they have totally different habits, and control measures against one pest will not always affect the other.



Odontria zealandica. Above, from left—First-, second-, and third-stage grubs, and pupa or resting stage. At left—Adult beetle.

GRASS-GRUBS

Though there is a great deal of work still to be done, the writer considers that there are grounds for considering that economic control measures against grass-grub will be found within the next 2 years.

There are numerous species of grass-grubs in New Zealand, but fortunately only five or six of them are of economic importance. Two species (*Odontria smithi* and *O. striata*) cause extensive damage in home and market gardens; two (*O. xanthosticta* and *O. puncticollis*) have been recorded as causing severe damage to nursery stock; and the *Pyronota* spp. and *O. zealandica* are the two recorded from pastures and forest nursery stock. *Pyronota* species have caused pasture damage apparently in the Waiuku, Wellington (1), and Nelson (2) districts only. *Odontria zealandica* is the grass-grub so familiar to farmers throughout both islands, but more particularly in Canterbury, the Waikato, and the Hauraki Plains.

Considerable Losses

Losses from grass-grub attack are considerable. In 1932 (3) in the Manawaru and Shaftesbury districts in the Thames Valley 1500 acres were damaged; in 1939 (4) it was estimated that 30,000 of 80,000 acres damaged in Canterbury would have to be resown; during 1942 (5) the annual loss to Canterbury farmers alone was estimated at more than £500,000 and the loss in national assets close to £12,000,000. D. Miller (6) records that at the Tapanui forest nurseries grass-grubs destroyed 500,000 seedlings in 1924-25 and 1,500,000 the following season.



General view of pasture damaged by *Odontria zealandica.*

Farm losses are not confined to damage by the grubs themselves, however, because the adult beetles (known as night beetles, turnip flies, brown beetles, or grass-grub beetles), which fly for about ¾ hour just after dusk from November to January, have been known to cause complete loss of cruciferous crops that were in the seed-leaf stage during the flight period of beetles. Beetles also may cause total defoliation of fruit trees (particularly stone fruits), ornamental shrubs, hedges, and shelter belts. Rose flower buds are frequently eaten back from the tips and look as if the points had been sliced off by a sharp knife.

Increase in Grass-grub Damage

The main reason for the increase in severity of grub damage is undoubtedly the extension of, and improvement in, pasture lands. Before introduced grasses and clovers were established there were only patches or even isolated tussocks or tufts of grasses, and though grass-grubs also feed on shrub and tree roots, improved pasture lands provided an unlimited and continuous supply of food. Since grass-grubs are markedly cannibalistic, they must originally have had vigorous competition for available plant roots, but today's pasture lands provide a continuous mat of roots, so that there is ample food for a much higher grub population than when the cover was sparse native grasses. This explanation is borne out, too, by the grub populations in irrigated and non-irrigated land in Canterbury. Irrigated paddocks have a more vigorous pasture cover and root system, and sampling shows that they can harbour without showing damage much higher grub populations than can non-irrigated land of the same soil type.

Life Cycle and Habits

Though the species causing economic damage all go through the complete cycle from egg to adult in 12 months, *O. smithi* and *O. striata* appear to have partly overlapping generations. A small percentage of *O. zealandica* grubs often may be found throughout the year, but in general the cycle is completed in the year.

The adult beetle of *O. zealandica* is a small, shiny, light to dark brown insect usually not more than ¼in. long;

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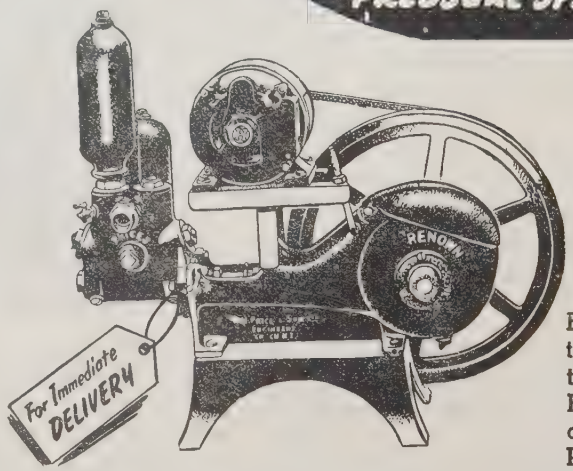
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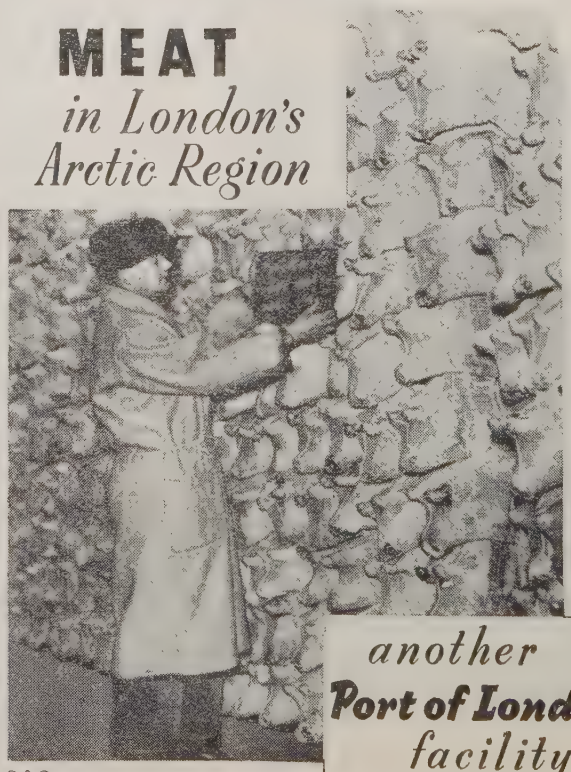


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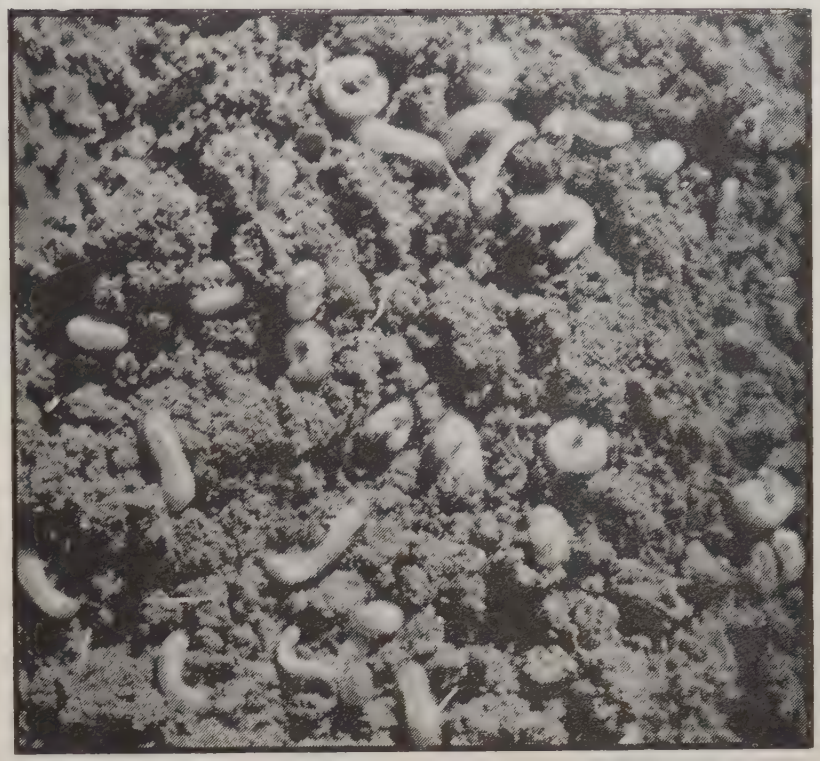
it may be found in the soil from September to February, but normally does not emerge until the last week in October at the earliest, and usually not until the first and second weeks in November. There are frequent reports that the beetles fly in large numbers as early as mid-September, but it has not been proved that such beetles are *O. zealandica*. However, there is no absolute consistency at any stage in the behaviour or development of these insects and it is always possible to find occasional beetles emerging at abnormal times.

Collections made every evening throughout the emergence period showed that male beetles usually emerged earlier in the year and earlier in the night than did females. This has an important bearing on subsequent infestations in any area, because it results in female beetles being mated almost as soon as they appear from the soil each night; mated females seldom fly and, providing the pasture is fairly good, will feed near emergence points. If females have not been mated by the time they climb to the top of neighbouring pasture, they invariably fly, and it is these individuals that may be seen on hedges, shrubs, fruit trees, etc., where mating then takes place.

Net collections made just above pasture during the first 5 minutes of flights seldom included more than 2 per cent. of females; collections made by sweeping nets through tops of pasture yielded not more than 25 per cent. of females, and usually much less. Collections made on ornamental shrubs or hedges and on pasture or lawns indicated that about 5 per cent. of female beetles fly from areas in which they emerge; 95 per cent. will not fly from emergence sites unless pasture cover has been nearly or completely destroyed. This is probably the main reason why grub damage gradually increases in severity over the years until a peak is reached, when cover is more or less removed entirely, and then grubs may not be seen in that area for some years.

Beetles continue to emerge throughout January and even into early February in Canterbury. Large flights of beetles do not occur—in Canterbury at least—when temperatures are lower than 49 degrees F., when there is light or heavy rain, or when winds are more than 10 miles per hour, but beetles will emerge and feed under these conditions.

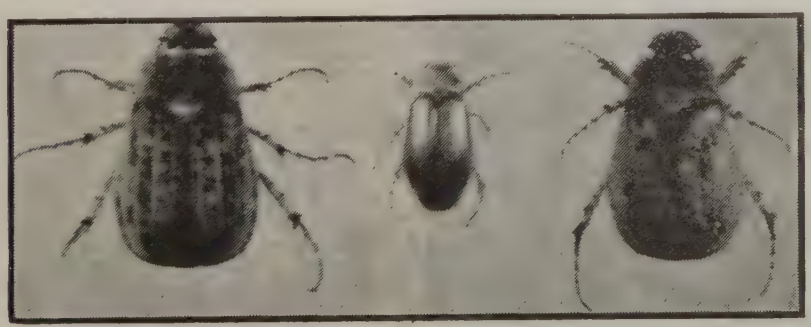
A few beetles may fly on any night even in adverse weather.



Odontria zealandica larvae in the soil.

Food Preferences

Beetles feed on a wide range of plants and trees, preferring with shrubs and trees the leaves or flowers of deciduous groups; stone fruits particularly may be damaged and may be defoliated in years of heavy beetle flights. Of pasture plants, clovers (leaves and flowers) are preferred, though grasses are eaten also. All cruciferous crops are liable to severe injury and records show that paddocks of turnips and rape may be destroyed overnight if they are in the seed-leaf or young 4-leaf stage, though more mature crops of these plants are not usually damaged so badly. Feeding takes place as soon as mating is completed, and where pasture is good, feeding is normally confined to the neighbourhood of mating sites.



Adult grass-grub beetles. Left—*Odontria smithi*. Middle—*O. zealandica*. Right—*O. striata*. All cause damage.

Light Traps

Traps for collecting flying beetles by attracting them to lights or fires have been used experimentally and as a means of control. In some districts hedge clippings were commonly kept and burnt at night during beetle flights, and by this means thousands of beetles were destroyed. However, counts made of beetles caught in light traps show that control by traps and fires is not as effective as might be supposed. It is possible to secure considerably more than 2000 beetles per trap each night without trapping any females. During the earlier half of the emergence period it is unusual to find 5 per cent. of females in light traps, but the percentage gradually increases over the last half of the flight period, until the females caught may represent nearly 25 per cent. of total collections. Over the whole flight season in 1949-50 less than 5 per cent. of the beetles caught in light traps were females. Strong lights attracted more beetles than did weaker lights.

The damage done by beetles during the emergence period is much less than that caused by larvae, but attention must be given to the problem as it relates to cruciferous crops, fruit, and ornamental trees and shrubs.

Egg Laying

Tests have shown that eggs are not laid before the seventh day after first mating, though beetles nearly always tunnel into the ground during the day. From the seventh day onward eggs may be found in clusters 3 to 7in. below the surface, according to the degree of soil moisture, with 3 to 40

eggs in each cluster. The average number found in a group is about 22, and the maximum number laid by a single female during her lifetime under laboratory conditions was 52. There are usually time gaps of from 4 to 9 days between the laying of successive batches of eggs.

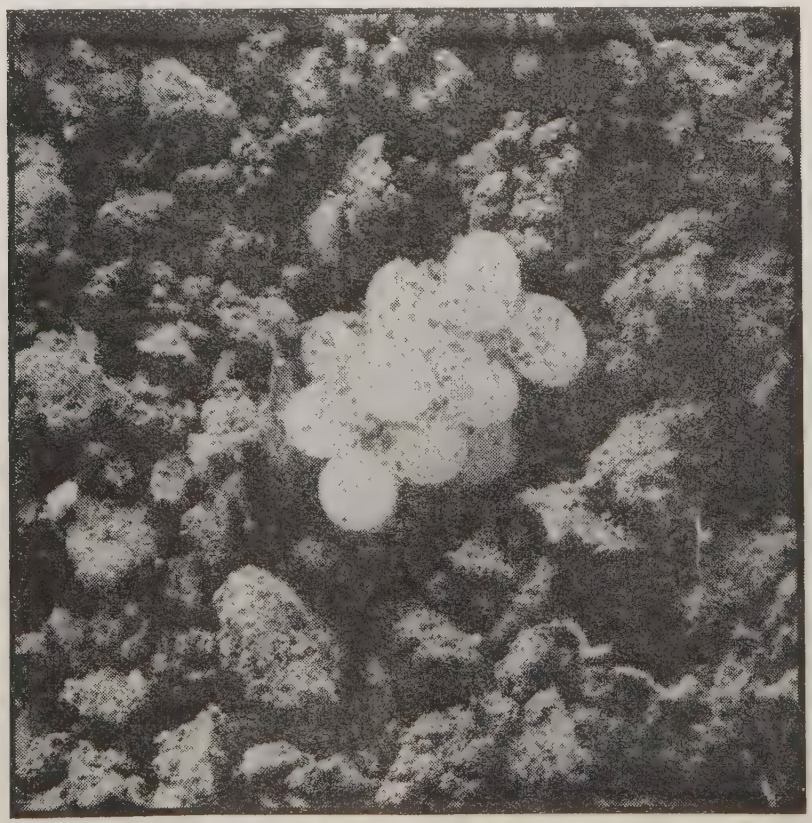
Eggs, which can be seen readily with the naked eye, are oval and coated with a clear, sticky fluid that makes them adhere closely to dry surfaces. When freshly laid, eggs sink in water, in which they remain viable for over 7 days. If egg surfaces dry out and the eggs are then placed in water, they will float for some time before sinking. Eggs are able to withstand fairly drastic extremes of alternate drying and wetting without being destroyed. For development they require to be in contact with moisture, and laboratory tests show that the presence of soil is unnecessary, because they develop satisfactorily in distilled and tap water. Where moisture is adequate eggs increase in size by absorption of water through the elastic egg membrane until by the time they hatch they have increased in bulk by 25 per cent. of their original size. Hatching occurs in from 16 to 21 days and by the tenth day the jaws of the developing grub may be seen through the transparent shell. Eggs are sometimes eaten by beetles if populations of the latter are very dense and soil moistures are low.

Three Grub Stages

When eggs hatch, the larvae or grubs begin to feed almost immediately, commencing on roots in the immediate vicinity. Young grubs, which are extremely active, are crescent shaped and white, with a brown head, 6 well-developed legs, and a blackish hind end. They do not come above ground to feed at any stage during their development, and injury to pasture is confined to root systems. It is quite common to find as many as 150 grubs per square foot of ground, and under such heavy concentrations they soon destroy most of the finer plant roots below the top 2in. of soil.

After about 4 or 5 weeks (exceptionally, as long as 12 weeks) the first-stage larvae, as they are called, cease feeding and change to the second and larger stage, in which damage to root systems becomes more marked. Second-stage grubs are normally found anywhere in the top 2in. of soil, and, depending on the number per square foot, may cause the first visible symptoms of pasture damage—a patchy yellowing of top growth.

Grubs spend from 5 to 10 weeks (sometimes 16 weeks) in the second stage and then move down in the soil about 3in., where they change to the third and final grub stage, in which state they may be found wherever roots are present. Where grub populations are high plant roots usually have been destroyed up as far as the top inch of soil by the time the third stage is reached. This results in most third-stage larvae being found in the top inch of soil, where they may be seen when damaged pasture is pulled or rolled aside. Third-stage larvae may be found from the end of February until the end of December and a small percentage sometimes continues beyond this period.



Grass-grub egg cluster (magnified) in the soil.

With their increase in size in the third stage the grubs require more food, and damage to root systems is severe. It is during this stage that pasture loses its root hold and soil becomes soft and spongy as grubs move through it. Observations made on farms over several years indicate that there is a very high natural mortality among grubs from the time that eggs hatch until third-stage larvae cease feeding. Many factors contribute to the population reduction, but it appears that cannibalism is probably the most important. (It will be discussed later under controlling agencies.)

Pupal or Resting Stage

From June onward the oldest of third-stage larvae gradually eat less and less and their bodies become filled with yellowish fatty matter. At this stage some of them begin to move downward in the soil until by the end of September most are below the 3in. soil level. Though occasional larvae may enter the pupal or resting stage as early as mid-May, it is not usual to find them in considerable numbers until the end of September, and most of them become pupae in October. In this stage they are found from 4 to 10in. below the surface in oval, earthen cells.

In the pupal stage there is resting only from feeding and locomotion, since it is during this period (which occupies from 4 to 6 weeks) that the insect changes into the adult beetle. At first beetles are cream coloured and sluggish, but they change slowly through shades of golden yellow to the typical brown. Apparently mature beetles may be found in the ground occasionally as early as July, but normally they will not be numerous until October, and these adults remain in the ground until about the end of the first week in November, when the whole cycle is repeated.

Control of Beetles

It is considered that light traps and fires for destroying flying beetles are of little practical value as control measures. This is based on the fact that under Canterbury conditions, where there are very few suitable hedge plants for food and where hedges are usually relatively far apart, experiments over the past few years showed that the female beetles caught in light traps represented not more than 5 per cent. of those that remained in paddocks laying eggs, despite the fact that thousands of mating pairs can be found in hedges, shrubs, etc. An exception is where pasture is so severely damaged that beetles fly from emergence sites to lay in better pasture, but even in these instances it is doubtful if many female beetles would be attracted to lights or fires.

Use of Smudges

D. Miller (6) records that at the State Forest Service nursery at Tapanui D. J. Buchanan worked out a successful smudge method for preventing beetles from laying eggs in young nursery stock during flight periods. Sulphur was sprinkled plentifully on strips of scrim which were then rolled up and placed in old paint tins or other suitable containers throughout the areas to be protected. The scrim was lighted at dusk except on stormy

nights, when beetles did not fly in any case, and it smouldered throughout the night, giving off dense clouds of heavy fumes that proved a very effective deterrent to beetles. In the nursery 2,000,000 trees were lost in the 2 years before the use of the smudges, but the year they were used the whole planting of 3,500,000 seedlings covering more than 5 acres was saved despite strong flights of beetles. Smudges, in preventing beetles from laying, also protected nursery stock from damage by grubs throughout the year following the flight.

Irrigation has been claimed to drown beetles, but observations in Canterbury disprove this and in fact indicate that irrigation waters tend to disperse over a wider area beetles that were sheltering during the day in dry races.

Control by Animals

Several animals control beetles to some extent, but insufficiently to prevent beetles from damaging pastures. Of these, birds such as starlings, crows, magpies, and sparrows are probably the most important, with hedgehogs next. Some of the ground beetles destroy large numbers of grass-grub beetles during the flight season in Canterbury. A nematode worm which will kill both larvae and adults of *O. zealandica* has been introduced from America to aid control, but it is too early to estimate its possibilities in New Zealand.

Farm Management

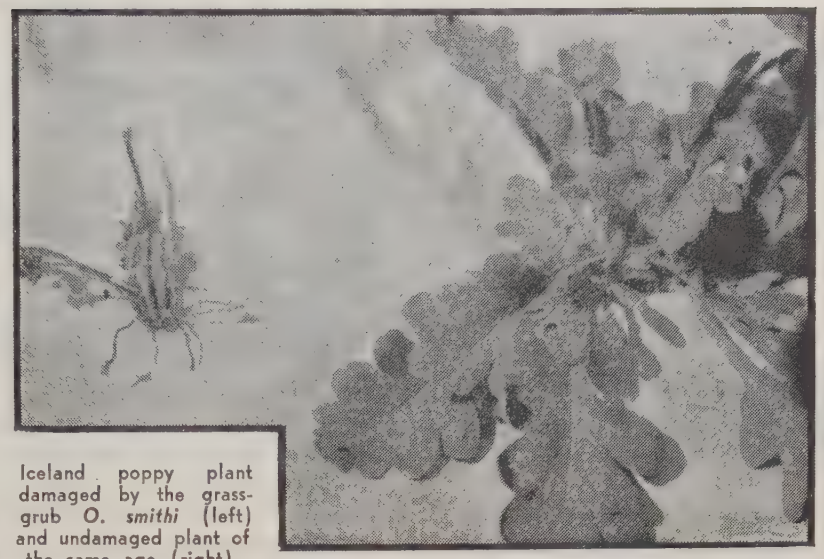
Farm management assists in reducing populations. If land has been worked up finely and fallowed for some months before flights, beetles do not in normal seasons lay eggs in fallow land, but during drought periods they will in preference to laying in hard-baked ground covered with pasture. Eggs will be laid also in recently worked land containing large amounts of vegetation (roots or top growth) and in open ground under rape, turnips, carrots, etc.

It is not advisable to have cruciferous crops in the 4-leaf stage during beetle flights. The alternatives are to sow rape, etc., sufficiently early so that it will have six or more leaves (including the seed leaves) by November 1 or to delay sowing until the end of January.

Ploughing and cultivation to destroy eggs would not be a practical control method, as eggs are remarkably resistant to drying. Of 50 eggs which were subjected to alternate drying and wetting (drying was carried to the point where shell membranes began to collapse) just over 83 per cent. produced apparently normal larvae when left on damp paper to develop.

Chemical Control

Chemical control of beetles has been tested, and though several insecticides gave fairly high-percentage control, it is not considered that this is a practical method for general farm use, as sufficient beetles lay eggs to carry on severe pasture damage in subsequent seasons. Medium-volume sprays on pasture using 1½lb. of B.H.C. (benzene hexachloride) or D.D.T. in 160 gallons of water per acre gave statistically significant control compared with untreated areas, but did not prevent beetles laying sufficient eggs to damage the same area severely the next season. Spraying of hedges in Canterbury at the dosage mentioned did not prevent major damage to pasture in the vicinity of those hedges. A further series of experiments showed that low-volume sprays on pasture, using 3 to 4 gallons per acre, were not likely to prove of any practical value, because the amount of spray, though giving excellent coverage, was sufficient to treat only the pastures and did not reach the ground. Under Canterbury conditions it is not possible to leave treated paddocks ungrazed for 2 months during the flight period of beetles, and stock very quickly eat the pasture coated with insecticides.



Iceland poppy plant damaged by the grass-grub *O. smithi* (left) and undamaged plant of the same age (right).

No ill effects were apparent in sheep that had grazed on treated pastures.

Control of Larvae

The opinion that irrigation will drown grass-grubs is unfounded, as tests show that irrigation waters do not linger sufficiently long, except at the bottom ends of borders or in depressions, to drown grubs. Irrigation does, however, promote a much more vigorous root system of pastures, and the latter can better withstand the effects of a heavy grub population than can non-irrigated pastures. A feature partly offsetting this is that irrigation supplies nearly optimum soil-moisture conditions for hatching of eggs, and the more vigorous root system supplies adequate food for a higher grub population than does the weaker turf on non-irrigated land. Observations indicate that, on the average, severe grub damage will show up a year sooner on irrigated land than on non-irrigated. This effect can be nullified by rolling affected land where possible.

Agricultural Salt Ineffective

Reports that common agricultural salt at a rate of 2½cwt. per acre is a cure for grass-grubs have not been substantiated by experiments by W. Cottier, Senior Entomologist, Plant Diseases Division, Department of Scientific and Industrial Research. The reported successes of this method have probably not taken into account the fact that grub damage after reaching a peak in any one paddock apparently disappears from that land and is not noted again for from 3 to 15 years, and the pasture recovers if temperatures and soil moistures are right. If salt application coincided with peak damage, it is possible that the disappearance of grubs would be attributed to the salt. Cottier in 1933 carried out field tests using salt at the rates of ¼, ½, and 1 ton per acre. Results were very disappointing, as with the lowest dosage results were little better than on untreated areas, and the two heavier dosages did not reduce grub populations beyond the danger level and in addition caused a marked deterioration in quality of pasture from effects of the salt.

Effect of Lime

Liming is reported to encourage grass-grub establishment, but investigations do not bear this out, and it is considered that any increases in larval populations would be due to improvement in vigour of pasture and root systems. This could arise with any chemical that benefited pasture. It could be claimed, however, that the improvement in root systems due to liming encouraged grass-grubs by permitting larger numbers to survive.

Birds

Birds are responsible for marked diminution in numbers of grass-grubs in pastures when grubs are in the third stage and close to the surface. Starlings, magpies, and crows are of most importance, though the last-named cause severe damage by uprooting pasture plants. During farm cultivation in Canterbury, starlings and sea birds of several species are of major importance in reducing grass-grub populations, and with repeated grubbing and long fallowing the larval populations can be reduced by these birds to a point where the effect of grass-grubs on subsequent crops is insignificant for up to 2 years.

Natural Controlling Factors

There are several natural controlling factors present in New Zealand and of these a bacterium causing "milky disease" sometimes exercises a fairly high degree of control in the first and second stages of grubs. The

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bacterium is present throughout both islands and is probably carried from one area to another by birds; its overall effectiveness is difficult to assess, but is probably not great. A similar bacterium has been introduced from America, where reports are favourable under certain conditions, but cost of preparing the spore dust is considerable. A nematode worm of *Mermis* species is plentiful in localised areas in Canterbury, but it too must exercise a fairly low degree of control. Another nematode has recently been introduced from America, and though it gives excellent control under laboratory conditions, it has not been liberated so far in the field, and it is not possible to predict its potentialities as a practical control. Other controlling agents are the larvae of ground beetles (carabids) and robber flies (asilids); the carabid larvae in particular are very voracious and destroy many grass-grubs before they reach maturity; the asilid larvae appear to require only 1 or 2 grass-grubs in order to reach maturity.

The Entomological Research Station of the Department of Scientific and Industrial Research recently introduced several insect parasites from Australia and two of them have been recovered from the field, where they appear to attack two of the New Zealand grass-grub species. At Ashburton one of these parasites has been recovered in each of the two years subsequent to liberation. Theoretically, use of parasites is the ideal means of control, since, apart from the initial cost of securing supplies of suitable types, there are no routine maintenance charges; the parasites continue to multiply as they reduce the grass-grub populations. However, in practice, use of parasites is not simple, as there are numerous factors such as temperatures, adult feeding habits, and related subjects, any or all of which may reduce or completely nullify the effect of parasites. It will not be possible for some years to estimate the ultimate effectiveness of the parasites so far liberated.

Though it is very gratifying that at least one species of parasite has been recovered in each of the two years subsequent to liberation, it is still too early to say that permanent establishment has been secured.

Field sampling and laboratory tests lead the writer to believe that cannibalism is the main natural factor limiting grass-grub populations in any area. The following example will give some indication of how cannibalism can reduce grub numbers.



Carrots damaged by *O. zealandica* compared with undamaged carrot (middle).

During a drought year samples taken in an 11-acre paddock of rape and turnips gave a population average for first-stage larvae of 141 per square foot. Samples were taken each 3 weeks and by the end of 3 months the average population was 8 per square foot. In this area the natural controlling agents were a few birds, isolated carabid larvae, less than 1 per cent. of "milky disease", and cannibalism.

Grub populations were so high initially that the turnip and rape crop was reduced by over 75 per cent., and as plants died due to grub activity the larvae moved to remaining plants. This resulted finally in a concentration of grubs round roots of remaining plants with the result that larvae had to compete with one another for available food. Inspection showed that most larvae had injuries either to legs or bodies, and it was common to find dead grubs that had been partly eaten or were being eaten by other grubs. This population reduction of over 94 per cent. was considered to be due in the main to cannibalism, as it was a drought season and larvae were deeper in the ground than is normal where birds play a part in destroying them.

The drought, too, was probably partly responsible for the rapidity of population fall, because plants that had their roots eaten off wilted immediately, whereas they usually recover to some extent if there is sufficient moisture in the soil. Laboratory rearing tests showed that it was not possible to rear through to mature adults more than 4 to 6 feeding larvae in containers 9in. in diameter with a 5in. depth of soil unless a very vigorous root system was present. Glass-sided observation cages ¾in. wide containing soil with grasses growing on top permitted grub activity to be watched, and it was found that the degree of cannibalism in these and in 9in. diameter containers increased as soil moisture decreased and as root systems were reduced.



Grass-grub enemies. Introduced thynnid parasite: Left—Cocoon. Middle—Female (wingless). Right—Male (winged).

Farm Management

Under Canterbury conditions where land is flat and heavy rollers of from 6 to 12 tons are available it is possible to save even severely grub-damaged pasture. The rollers were designed primarily to push stones into the ground so that they would not be picked up by mowers, balers, etc., but tests show that they are effective also for retaining pastures in face of grub populations as high as 65 third-stage larvae per square foot. Sampling showed that the effect of rolling is not to kill larvae; though small numbers are killed, most are not adversely affected. Rolling merely consolidates grub-damaged pasture and by forcing it into contact with moist soil permits it to reroot at a time when grub feeding is on the decrease.

In general it has been found that best results are obtained by rolling pastures from the beginning of June to the end of August, but excellent results have been obtained, mainly on irrigated land, by rolling as early as the first week in April; the best time will vary from farm to farm and owners will have to make their own decisions. The period June-August is suitable for the following reasons:—

From June onward some grass-grubs are becoming fully fed and in consequence destruction of pasture roots gradually decreases.

There is adequate soil moisture even on non-irrigated farms; it is necessary for promoting root growth and for

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adequate soil compaction. (On irrigated paddocks rolling can be carried out in September also, but this month often is the beginning of prolonged dry spells in Canterbury, and injured pasture dries out to such an extent on non-irrigated land that winds dry up and blow loose tufts of grass off such areas.)

Though soil temperatures are too low to give noticeable top growth, rerooting continues at temperatures below 40 degrees F. After rolling paddocks it is preferable to keep stock off them for at least 3 weeks; otherwise stock may again lift tufts of grass before rerooting has taken place.

It should be noted that the use of rollers is not in the true sense a controlling agent for grass-grubs. Grubs will complete development and produce adults which, because the pasture has been saved, will almost certainly deposit most of their eggs in the same paddocks, so rolling will have to be repeated the next year. What happens ultimately is not known, as to date tests have been carried out on the same areas for only two successive seasons. It is considered, however, that of the natural controlling agents cannibalism alone will keep the population at a fairly fixed level in relation to a given density of root systems.

Heavy stocking with sheep or feeding out of hay on grub-injured pasture has a threefold effect:—

Sampling shows that sheep feet have a greater crushing effect on grubs than have heavy rollers or sheep's foot rollers.

Soil loosened by grub activity is consolidated and so permits rerooting of pasture, whereas frost action prevents it if the soil is loose.

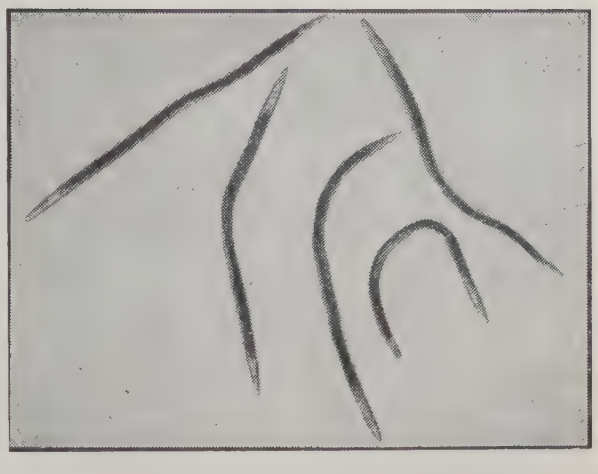
There is reseeding from the hay.

Chemical Control

Chemical control of grass-grubs has received attention since grub damage first became apparent, and though effective methods had been worked out for high-return crops such as strawberries or for home or club lawns, the costs are far too high for general farm use. The most effective of the older methods was to use lead arsenate at rates of from 5 to 10lb. per 1000 sq. ft. of garden or lawn, applied as a spray or by water can and then washed in by a hose, using about 50 to 100 gallons per 1000 sq. ft. of lawn, or as a dust mixed with dry sand or soil at a rate of from 10 to 14lb. of sand with each 1lb. of lead arsenate per 100 sq. ft. of lawn. These dosages work out at from 218 to 436lb. of lead arsenate per acre, and the cost is far too high for general farm use. Cottier (7) reports that lead arsenate is slow in action and that it takes approximately 18 weeks before any appreciable reduction in grub populations is noticeable.



Grass-grub enemies. Carabid beetle (left) and larva (right). Both destroy large numbers of grass-grub beetles and larvae.



Grass-grub enemies. Specimens of introduced eelworm parasite.

Experiments over the past 3 years in Mid- and South Canterbury by the Entomological Research Station have shown that some of the newer insecticides such as B.H.C., D.D.T., rothane (D.D.D.), and chlordane may be substituted for lead arsenate and reduce the cost of treatment considerably. Though tests are not completed, sufficiently conclusive results have been secured to justify mention of them. All the above chemicals have a residual toxicity lasting more than 1 year and are also effective against both harmful and beneficial insects, so that they should be applied when there will be no danger to pollinating agents such as bees and moths. If this precaution is taken, there will be no danger to beneficial insects. The insecticides may be applied at any time from March to November. For best results it is necessary to have pastures close grazed for both spray and dry applications and it is most important when it is intended to use clovers, etc., for seed yields. In these instances it is recommended that only dry treatments be applied when pasture is dry so that insecticides fall off pasture on to the ground.

Trials in Mid- and South Canterbury in March, May, July, and December, 1947, with B.H.C. and D.D.T. dusts and D.D.T. superphosphate showed that fair to good pasture recovery was secured in the presence of grub populations as high as 20 to 44 per square foot. These populations are normally high enough to cause marked loss of pasture cover, and it was therefore obvious that the grass-grubs were being affected in some manner by these insecticides. Superphosphate treated with D.D.T. and B.H.C. and applied in May, 1948, permitted good pasture recovery in face of infestations by both grass-grubs and *Oxycanus* and by February, 1949, reduced grub populations below those in untreated areas. It was then realised that though D.D.T. and B.H.C. kill first- and second-stage grubs, a peculiar feature of these new insecticides is that the third-stage grubs are markedly resistant to them. However, the treated pasture recovers to some extent, though not as well as when first- and second-stage grubs are present, in spite of the presence of large numbers of live larvae; that is, third-stage grubs are not killed but are apparently incapacitated.

Low-volume sprays did not give good results, as nearly all of the insecticide was retained on pasture which was grazed off by stock. High volumes (1500 gallons per acre) gave good control.

Treatments applied in July, 1949, were as effective as those of the following November and both retained their effectiveness against the generation of larvae following the November-December flight. The plots were on farms and each was 1/40 acre, with five replicates of each dosage, and as no alterations were made in normal farm practices, results should give a fair indication of the effectiveness of the insecticides under field conditions.

Sampling on the high-volume plots showed that the average larval populations per square foot for 100 samples for each dosage were 4.89 for D.D.T., 7.17 for B.H.C., 9.09 for rothane, and 13.32 for chlordane. On untreated plots the figure was 20.25. Point analysis of pasture cover showed that it was 128 per cent. better on B.H.C. plots than on untreated plots, 121 per cent. better on D.D.T. plots, 59.7 per cent. better on rothane plots, and 45.8 per cent. better on chlordane plots.

B.H.C. and D.D.T. have been used as dusts or mixed with superphosphate in further series of tests on a farm scale; with the latter each dosage (0.8 and 0.4lb. of 100 per cent. B.H.C. and 1.6 and 0.8lb. of 100 per cent. D.D.T.) was replicated twice and plots were just over 1 acre. Insecticides were applied in early May, 1949, and by the end of September, 1950, the pasture on D.D.T. plots was significantly better (93 per cent. and 92.8 per cent. pasture cover) than on B.H.C. plots (75 per cent. and 54.25 per cent. pasture cover). The average larval population per square foot for 50 samples was 2.2 with the heavier D.D.T. dosage, 7 with the lower dosage, 4.7 and 7 with the two B.H.C. dosages, and 12.4 on untreated areas.

Results in this series were complicated by the fact that there was also an infestation of *Oxycanus* each year to contend with. However, D.D.T. controlled this pest also as is indicated by the following figures for 1950: There was an average caterpillar population

in September, 1950, for 50 samples of .06 per square foot on D.D.T. (higher dosage) plots, 3.4 on B.H.C. (higher dosage), and 4 on untreated land. This D.D.T. series, therefore, was still a very efficient controlling agent for grass-grub and *Oxycanus* 16 months after application.

Treatment with the insecticide incorporated in superphosphate or other fertiliser is a much more practical control than by the high-volume methods, as the weight of the 1500 gallons of water per acre used would be nearly 6.7 tons without the container and other apparatus. On the other hand treated superphosphate can be applied with ordinary farm implements by farmers. Practically identical results were secured with all methods (spray, dust, or treated superphosphate).

Of the insecticides tested there was little difference between equal dosages of D.D.T. and B.H.C. in the first year, but the former gave better control the second year; it was also cheaper and more pleasant to handle. D.D.T. in superphosphate is recommended for grass-grub control—a dosage of 1lb. of 100 per cent. D.D.T. an acre for general grazing land, 1½lb. an acre for high-return pastures, lucerne, etc., or 2lb. an acre where *Oxycanus* is present in addition to grass-grub.

Though treatment can be carried out at any time to suit the farmer's convenience, applications between April and August will not give control of grubs in the third stage. Treatments applied between September and November will give good results by the end of the following February and March. The following precautions must be observed in the use of insecticides:—

Where low- and moderate-volume sprays are used large amounts of insecticide remain on good pasture; it is eaten by stock and so is ineffective against grubs or it may cause taint of animal fats and butterfat. (This is being investigated.)

For best results apply insecticide-treated superphosphate when pasture is close grazed and dry to avoid adherence of insecticides to pasture, or during heavy rains, if practicable, so that insecticides will be washed on to the ground.

Do not apply dry insecticide mixtures or sprays to clovers, etc., when they are in the flower-bud or full-bloom stage, because pollinating agents such as bees, moths, etc., will be killed.

If there is a breeze, hang canvas or sacking curtains behind drills or topdressers to prevent loss of insecticide.

Rotary-type topdressers are not suitable for applying D.D.T.- or B.H.C.-superphosphate, as the amounts used per acre are so small and the particle size so fine that a high percentage of insecticide will be blown away before reaching the pasture for which it is intended.

As D.D.T. and B.H.C. are not soluble in water, it is unlikely that they will be taken up into plant tissues through root systems and so cause taint of crops or animal fat by that process.

A further indication that dry treatments using D.D.T. will be effective against grass-grubs comes from extensive trials on playing areas (tennis and croquet lawns) and home lawns in Ashburton. The dosage used was 1½lb. of 50 per cent. wettable D.D.T. mixed with 61lb. of dry sand or soil or with 61lb. of the standard, fine-grass lawn topdressing (3 parts of ammonium sulphate and 1 part of superphosphate), and applied at a rate of 1oz. of the mixture per square yard (that is, the amount is sufficient for 1000 sq. yds. of lawn). Alternatively the 1½lb. of D.D.T. could be applied in water, using 100 gallons for each 1000 sq. yds. of lawn. D.D.T. could be used profitably in forest nursery stock or general nursery treatment, as conifers, deciduous ornamental trees, shrubs, and orchard trees are often severely damaged by grass-grubs; for this purpose the D.D.T. could be applied either dry or as a spray. If sprays are more suitable, it is suggested that the D.D.T. be applied at a rate of 2lb. in about 150 to 200 gallons of water per acre and then washed into the soil by using a further 300 to 400 gallons per acre.

Tests involving treatment of pasture, cereal, and cruciferous seeds with D.D.T. and B.H.C. before and at sowing are under way and preliminary results are promising, but tests must be repeated over longer periods and with various soil-moisture conditions before definite recommendations can be made on this approach to grass-grub control.

Conclusions

1. Grass-grubs were responsible in 1950 for losses to farmers and forestry concerns of approximately £2,000,000.

2. To prevent beetle attack to cruciferous crops sow early enough to ensure that they have 6 leaves (including seed leaves) by November 1, or delay sowing until the end of January.

3. Fruit and ornamental trees can be protected from beetle injury by spraying them with D.D.T. at a rate of 1½lb. of 100 per cent. (or its equivalent) in about 200 gallons of water, using 3 to 5 gallons of the spray for a tree about 7ft. high by 10ft. wide. Do not use D.D.T. if flowers have not been pollinated, as bees, moths, etc., will be killed.

4. Where heavy rollers (6 to 12 tons) are available, grub-damaged pasture can be saved by rolling it from June 1 to end of August. Rolling does not, however, kill many grubs.

5. If damage is patchy, feed out hay. Sheep feet have a greater crushing effect on grubs than have rollers, soil is compacted, and seeding from hay occurs.

6. High-volume sprays (1500 gallons per acre) containing 1lb. of 100 per cent. of the active constituent of D.D.T. or B.H.C. per acre gave good control.

7. Excellent control of grass-grubs and *Oxycanus* over a period of 16 months resulted from the use of 1.6lb. of 100 per cent. D.D.T. in 1cwt. of superphosphate per acre.

8. D.D.T. at a rate of 1½lb. of 50 per cent. per 1000 sq. yds. of lawn mixed either with 61lb. of the standard lawn topdressing or 61lb. of dry sand or soil and applied at a rate of 1oz. per square yard (sufficient for 1000 sq. yds.) gave good control of both grass-grub and *Oxycanus*.

9. Long fallowing of land and repeated cultivation results in sea birds, etc., picking up most grass-grubs and *Oxycanus*. Short fallowing and poor cultivation usually result in grub damage to succeeding crops or pasture.

The following general recommendations are made by A. H. Flay and H. E. Garrett, of Lincoln College (5), for Canterbury conditions:—

1. Extend the area in lucerne beyond that required for hay purposes, so that discriminate grazing of lucerne can be resorted to during pasture shortages due to droughts and/or grass-grub. Cocksfoot is a grub resister, and it and lucerne provide an excellent mixture for periodic grazing. One hay cut a year will appreciably lengthen the life of a periodically grazed lucerne stand. Although lucerne may be taken by grubs in the first year of the life of the stand, established stands are seldom affected.

2. Build up and carry a greater reserve of dry feed, especially lucerne hay, so that when stock numbers must be reduced, such "surplus" stock are disposed of as "fats" and not as stores. In addition permanent stock are maintained in good condition.

3. Fallow well and sow at least one paddock each year in Italian ryegrass and red clover or Italian ryegrass and greenfeed oats, so that a supply of greenfeed is always available for winter and spring together with adequate dry feed. After a lengthy fallow, at worst only patches of this new pasture or greenfeed will be eaten by grubs. Under most medium- and light-land conditions it is advisable to sow an area of greenfeed oats each year. In seasons when grass-grub attack is not severe it is advisable to give a paddock a good fallow and sow down to permanent pasture. Such new pasture sown on fallowed land provides a big bulk of greenfeed and might well replace Italian ryegrass in some seasons.

4. Always save grass and clover seeds. An area of ryegrass (Italian, perennial, or both) should be shut for seed, and red and white clover seed may be harvested in favourable seasons. Hold at least two years' supply of such "home-grown" seeds because, when grass-grub damage is severe, seeds are always dear.

5. When forced to increase the area in cash crops avoid early sowings of wheat or oats on land known to be severely infested with grubs. If late-winter or spring sowing is not wise on the particular class of soil or in the district, then sow wheat in paddocks not severely attacked and make spring sowings of peas, barley, rape, and turnips on badly affected areas.

6. Unless the whole paddock is ruined, do not be in too great a hurry to plough the affected area. Plough only for a specific and definite purpose. Where patches of paddocks are eaten out, often these will recover by feeding hay on them and then spelling them.

7. Avoid loss of rape and turnip crops at the seedling stage by sowing early or late, that is, before the *Odontria* is on the wing and/or after it has laid its eggs.

8. As a general policy on mixed farms and in grass-grub-infected areas, be slightly understocked rather than a little overstocked.

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Control of Willows with Chemicals

By R. K. WARD, Research Officer, Rukuhia Soil Research Station, Hamilton

WILLOWS, which may readily be propagated and established from cuttings, have been planted widely in river protection work in New Zealand for many years. Unfortunately, such plantations have rarely been kept under control. Today there are hundreds of miles of rivers, large and small, either badly choked with willows or rapidly coming to this stage. Consequently considerable efforts are now being directed toward the extermination of willows wherever they are thought to be a cause of flooding. Whether willow eradication will give the results expected or whether it will present engineers with other problems such as water-weed control or slip stabilisation only time will tell.



Willow infestation for which suitable treatment would be ring-barking or frilling and poisoning, aided by controlled stock grazing.

WILLOWS should never be planted or be permitted to establish unless they will definitely serve in river protection or in slip stabilisation. The advice of a catchment board officer should be obtained in this regard.

Once a plantation is successfully established the trees should be given periodical attention. Broken branches or tree trunks should be snigged out of the stream or from among the remaining trees immediately. Trees which have become top heavy or which lean out over the stream should be severely lopped and the pieces removed. Any timber not required otherwise should be cut into suitable lengths, split if very large, and stood on end to dry before the heap is burnt.

The roots of old trees are said to deteriorate in usefulness for protection work, and old trees should therefore be removed and replaced by younger trees by replanting or by layering.

Wherever possible the riverside should be fenced off and divided into paddocks which can be rotationally grazed. Periodical heavy concentrations of stock should be put on the paddocks and this should be followed by rests from stocking. The type of stock to be used will depend on circumstances, but none can be trusted to do this cleaning work satisfactorily unless fencing which will confine the stock to the area is provided. This procedure will go far toward eliminating undesirable weeds and preventing the gradual establishment of species such as blackberry, convolvulus, raupo, and sundry swamp-forming plants that tend to encroach on to adjoining clean land. Any threatened invasion of blackberry, gorse, or other shrubby weeds should be met with spray treatment with a 2,4,5-T hormone-type weedkiller.



Ring-frilling and poisoning methods. Upper—Making bark incisions with an axe and pressing lower edge of severed bark outward. Lower—Applying weedkiller concentrate with a pressure oil can.

Clearing and Eradication

The two chief methods of clearing and eradication in use are mechanical clearing and poisoning with chemicals.

The first method requires the use of heavy machinery such as track-laying tractors, bulldozers, and log haulers. Although it is the more rapid of the two methods, it has at least one disadvantage in that a complete clearance of all roots and fragments is not immediately possible. Regrowth from these fragments usually occurs, and then recourse is often made to poisoning.

The more important chemicals available for the poisoning of willow trees are included in the following types. A number of other materials have been used with, it has been claimed, some degree of success, but are not included in this outline.

Arsenical Weedkillers

Sodium arsenite is available on the market under various trade names.

Hormone-type Weedkillers

The three main groups of hormone-type weedkillers are the M.C.P., 2, 4-D, and 2,4,5-T types. These are available under a variety of trade names in various combinations and concentrations. Tests have indicated that M.C.P. materials are not as toxic to willows as 2, 4-D materials, and it has not been clearly demonstrated whether 2,4,5-T is either more or less toxic than 2, 4-D. It is claimed that the ester formulations of 2, 4-D are more toxic than the water-soluble salts and amines, and esters are generally used in willow-clearing operations.

Fuel Oil

Industrial fuel oil, dieselene, and, preferably, power kerosene may be used in a number of ways according to the size of the willow growth or to the preference of the user. No poisoning method should be expected to prove wholly effective after a single application. In all experiments carried out



Willow infestation on country insufficiently firm to support the trees. Mechanical eradication appears to be the only possible method.

by the writer and in practical clearing operations in the field which he has had the opportunity of observing it has been found necessary to go back over the areas a second or even a third time to complete the killing. In other cases where outright kills have been claimed it appears that the trees were uplifted and disposed of too soon after poisoning to be sure that no regeneration would have occurred had the trees been left standing.

Sizes and Types of Trees

The methods of treatment which follow relate particularly to the common crack willow and the weeping willow. The special cases of the pussy willow and the silver poplar are considered briefly at the end of the article.

Trees with Trunks or Limbs more than 6in. in Diameter

Girdling or ring-barking: In local trials with trees with trunks or limbs more than 6in. in diameter it appeared that provided the small number of shoots which appeared below the girdles the following spring were completely and immediately removed, this method when carried out in March and April gave practically a total kill. Only one tree weakly persisted, and this was attributed to the fact that as the trunk lay more or less horizontal and close to the ground, it was impossible to be sure that ring-barking was complete. All of the trees came into leaf the following spring, but most of the leaves soon yellowed and most were lost during the summer. At this time degeneration and peeling of the bark were observed above the girdles. Again, the second spring after girdling, a few scattered leaves appeared toward the tops of the trees, which, however, became virtually bare by midsummer and no further signs of recovery were observed at the end of 3 years. No further signs of sprouting from below the girdles appeared after the spring following the initial treatment.

In this particular trial the girdles or ring-barked bands were no wider than 6in., mostly less, but the work was done thoroughly. Other authorities specify a girdle of up to 18in. wide to ensure that the bark does not grow over the gap to restore sap circulation between root and crown of the tree. To increase the width of the girdle does not compensate for incomplete piercing of bark all round the trunk of the tree. However, if girdling, instead of being carried out in late summer, is done in spring, when the sap flow is at its strongest, greater precautions may be necessary.

Ring-barking and poisoning: When it is not possible to confine ring-barking to late summer and autumn it would appear advisable to augment this treatment by painting or spraying the wound with one of the following preparations: Fuel oils, a commercial arsenical weedkiller diluted 1 : 4, or one of the many hormone concentrates. If a 10 per cent. hormone concentrate is to be used, it should be applied without dilution, while a 40 per cent. concentrate should be diluted 1 : 4 in oil or water depending on whether it is an oil-based ester or a water-based amine concentrate. If, later, shoots appear below the wound, they should be stripped off early and the wound painted or sprayed over with the same preparation. In areas being heavily stocked this procedure should not be necessary, but careful inspection should be made for regrowth out of reach of stock. When an arsenical preparation is being employed stock should be excluded from the area for 2 or 3 weeks or until heavy rain has fallen. It has even been claimed that stock have been poisoned after eating dead leaves from trees killed by arsenical applications other than by spraying.

If grazing is to be relied on for the removal of shoots, care should be taken to do the ring-barking near ground level so that all shoots will be within reach of the animals.

Alternatively to stripping off or grazing the sprouts they may be sprayed as described later.

Frilling or frill-ringing and poisoning: Instead of removing completely a band of bark from about the trunk as in ring-barking, in frilling a single continuous circle of cuts completely severing the bark is made by a series of blows from an axe directed downward at an angle of about 30 degrees to the vertical. At the end of each blow the axe is twisted slightly to prise the lower edge of cut bark away from the tree trunk. If well carried out, this operation should leave a horizontal groove or furrow completely girdling the trunk of the tree. A promising method of frilling is the use of explosive cord, which is looped around the trunks and detonated. This cord has a core of explosive material and has been used successfully in some preliminary experiments. The groove should then be treated liberally with any one of the preparations suggested in the ring-barking and poisoning method. For this purpose a pressure oil can or a knapsack spray pump is very suitable. Regrowth, if any, arising later from below the frill may be controlled by stripping, by grazing of stock, or by spraying.

Felling (flush cutting) and stump treatment: In certain instances such as where a ready market exists it may be preferable first to fell the trees to recover the timber. For use as firewood willows are best felled during winter. If the area is inaccessible to stock, all stumps should be swabbed, painted, or sprayed liberally with a hormone or arsenical concentrate, but if trees are felled in winter, it is probable that much of the poison will be washed off before it has had effect, and much follow-up attention will be required in succeeding months. It might be preferable to confine winter felling to such locations as can be fenced off readily and subjected to grazing by heavy stock concentrations. Stumps of trees felled during the months of active growth are much more likely to respond to poisoning. Swabbing or painting may be augmented by drilling a number of 1in. holes to a depth of about 9in. and filling these with poison. A similar effect is obtained by "cupping", that is, making a number of deep horizontal gashes about the trunk and roots as in frilling and pouring poison into each gash.

Drilling and poisoning: This is a very old and well-known but rather unreliable method. A number of holes of about 1in. diameter and up to 12in. deep are bored into the base of the trunk and into exposed roots. The holes should be kept filled with an arsenical poison for some time. Some success has been claimed for the method, but when hormones have been tried the results have been disappointing.

Apparently success is in proportion to the number of holes drilled. Rather spectacular initial results were observed recently on a farmer's property. In trees of about 12in. diameter he had drilled up to 12 holes in groups of three, at the same time making extensive scarfs into the bark. The method is unlikely to appeal because of the tediousness of the work and of the probability of obtaining inferior results.

Recently attempts have been made to obtain kills by spraying a mixture of hormone esters and dieselene in a ring about 3ft. broad about the base of willow tree trunks.

Observations so far lead to the conclusion that the method, as far as willows are concerned, is unlikely to compete with others described. American workers have made claims for the method recently in relation to

certain woody plants other than willows, even when applied during the dormant period.

Small Trees up to 6in. in Diameter

Small trees up to 6in. in diameter are best lopped off and the cut surfaces of the stumps poisoned with hormones or with arsenical concentrates or else the stumps should be allowed to put out shoots which should be sprayed with hormone, sodium chlorate, or fuel oil sprays as discussed later, or controlled from an early stage by stock grazing.

Trees still in the green-bark stage have been killed in trials by painting or spraying a girdle round the trunk with the hormone weedkillers as applied to frilled trees. In such young trees cutting of the bark is not necessary to secure absorption of the weedkiller.

Young Shoots and Sucker Growth

Apart from control of young shoots and sucker growth at early stages by stripping or by concentrated stock grazing, the only alternative is to spray regrowth. With hormones, sodium chlorate, or fuel oil sprays there is no hazard to stock, and the one method can be made complementary to the other. It is generally necessary to follow up the work in 2 or 3 weeks with a second application to growth which appears to have been missed in the first spraying. It may even be necessary to repeat the treatment the following year. Apparently best results from spraying with hormones are obtained in spring, when growth is at the maximum. No useful purpose is served by spraying in the dormant season. Attention should be paid to twigs and branches as well as to the foliage.

Although sprayings made with sodium chlorate or oils give the most spectacular results when applied in dry, hot weather, it is undesirable to delay such applications because of the extra growth, woodiness, and density of foliage which develops by the end of spring.

Pussy Willows

Very good results have been secured in the Waikato following the spraying in March of young pussy willow saplings up to 1in. in diameter with a 5 per cent. sodium chlorate solution. A high proportion of outright kills has resulted.

Larger trees and bushes require to be cut down, after which the regrowth should be sprayed with one of the spray solutions mentioned in a later section. Good grazing management also contributes toward pussy willow control.

Silver Poplar

Although silver poplar is not a true willow, it belongs to a closely related group of plants. Silver poplar is extremely difficult to keep under control because of its habit of suckering profusely. Stock will not contribute greatly to the control of this sucker growth unless it is lopped down regularly to keep it from developing into thickets and unless hard grazing can be applied.

The adult tree should be eliminated by drastic poisoning, applied by the ring-barking or frilling method, while drilling could be used in addition. Sucker growth should be lopped back and regular spray applications made thereafter. If arsenical weedkillers are used, stock should be kept away, but if sodium chlorate, oil, or hormone-type sprays are regularly used, heavy stocking can be used to assist in controlling sucker growth. The complete eradication of silver poplar may require attention over two or more growing seasons.

Dilutions of Poisons

For Frilling, Ring-barking, and Stump Treatment

The following dilutions of poisons may be used for frilling, ring-barking, and stump treatment:—

1. Commercial arsenical weedkiller concentrates diluted at the rate of 1 gallon to 4 gallons of water.
2. Fuel oil undiluted.
3. Hormone concentrates: 10 per cent. concentrates applied undiluted; 20 per cent. concentrates diluted 50 : 50 with water; 40 per cent. concentrates, if oil-based, diluted at the rate of 1 gallon to 3 gallons of dieselene or power kerosene. If a water-based type is being used, it should be diluted with water instead of dieselene.

For Spraying Foliage and Young Regrowth

The following dilutions of poisons may be used for spraying foliage and young regrowth:—

1. Commercial arsenical weedkiller concentrates diluted at the rate of 1 gallon to 100 gallons of water. Add a wetting agent. Spray all foliage and young growth to wetness. Do not waste material through excessive run-off or dripping. Inspect the area within a month and spray again as required.
2. Spray liberally with undiluted fuel oil. Inspect and repeat spraying as in the preceding case.
3. Hormone concentrates: 10 per cent. concentrates diluted 1 : 50 with water; 20 per cent. concentrates diluted 1 : 100 with water; 40 per cent. concentrates diluted 1 : 200 with water for spraying. Inspect the work within a month and repeat spraying where necessary.

   An ordinary knapsack spray pump is all that is required for spraying young regrowth. As a supply of water is unlikely to be a problem, and as ordinary high-volume spraying will generally give better coverage, no particular advantage is likely to be attained by using special low-volume nozzles and dilutions.
4. Sodium chlorate. The usual concentration used for spraying purposes is 5 per cent. or ½lb. in 1 gallon of water.

Conclusion

Too much should not be expected from the first application of a poison to willows. The factors of thoroughness and regularity of follow-up attention are probably of greater importance than the type of poison decided on. The writer has observed as great differences in results obtained by two fellow workers using the same material as he would have expected to find had they used different materials.

The value of rotational grazing with heavy stock concentrations cannot be too greatly stressed. Not only will stocking assist greatly in the removal of suckers and regrowth, but if put into operation before poisoning or clearing work is begun, it will assist toward opening up the area by removing undergrowth. This may be of considerable value in disclosing the contours of the area, in planning the poisoning, and in making the area more readily accessible.

Some thought should be given to the future of the area it is proposed to clear. Will it be possible to stock the area or otherwise manage it so that conditions will not deteriorate again? Will the removal of the canopy of willow trees permit invasion of the main channel by aggressive water weeds such as *Glyceria aquatica*? If, by one means or another, the willows are killed but no other action is taken, there may be a dozen or more undesirable volunteers awaiting the chance to fill the gap. In some cases it is possible that a more profitable method of willow control may be by interplanting and smothering with a more valuable timber-producing type of tree.



Water weed invasion and willow sucker encroachment in an area where 3 years earlier clearing operations had been carried out.

SHADE FOR HOUSEHOLD POULTRY



Upper left—Growing pullets, even more than hens, need well-fenced runs with plenty of shade. Mash hoppers and drinkers should be shielded from direct sunshine. Upper right—A single pine tree may give adequate shade in a small run. Middle—Conifers give good shade and shelter, but the lower branches should be trimmed and pullets not allowed to roost in them at night. Lower left—Fruit trees, especially citrus species, peaches, and plums, supply excellent shade. Lower right—Ducks need shelter from sunshine just as much as they need drinking water and far more than they need swimming water.

[Lower right photograph by Sparrow Industrial Pictures Ltd.; all others by Fraser Niederer.

Runs and Shade for Household Poultry Pens

MOST household poultry keepers give their hens a fenced-in run. In many cases, poor as it is, the run is valuable because all too often the housing is inadequate. As a result too many birds have to exist for a long period of the year in muddy and damp conditions. In this month's article for the household poultry keeper W. L. McIver, Poultry Instructor, Department of Agriculture, Hamilton, advocates careful planning of the whole unit, from the site to the last tree planted for shade.

BACKYARD poultry housing without an outside run is so unusual in New Zealand that householders would appear to be firmly convinced of the necessity of runs. Yet many of them must have visited commercial farms and seen that, in the main, large flocks are kept inside on the intensive system with the probable exception of the breeding pens. To decide which method is better it is necessary to ascertain why the commercial poultry farmer provides no run-out when, under certain conditions, free range is clearly advantageous.

Comparison with Farming Conditions

The farmer understands the need to give the fowls not only comfortable but roomy housing. He uses costly building materials where many backyarders use makeshift timber. He plans the housing well and usually makes excellent provision for the ingress of direct sunshine, whereas the householder almost invariably closes in too much of the frontage and blocks out sunlight. The farmer treats the house as the important unit and any run is only supplementary; the backyarder evidently assumes that the run will make up for the deficiencies of the housing.

At best, an outside run can only ameliorate inadequacy of the laying house and its equipment. In wet weather it does not even do that.

The farmer grows greenfeed on a separate area and carries the greens to the fowls. Backyarders, depending on the run to supply extra space, tend to regard the grass in the run as sufficient for the requirements of the birds. For the benefit of the health of the birds and their egg yield too much stress cannot be laid on their need for plenty of fresh, luscious greens. Grass and weeds from the run or elsewhere on the property, including lawns, are of value at certain times of year, but as soon as the growth is rank or when the weather is hot enough to dry and wither the growth, weeds and particularly grass become useless for supplying vitamins and too fibrous for the digestive systems of fowls. Their internal organs cannot cope with too much fibre.

The farmer knows that land is so valuable that he cannot afford a larger area than is essential. Most suburban sections are of only ¼ acre, so the backyarder must appreciate as clearly as the farmer that any small piece of ground occupied year after year by fowls will become "poultry sick".



These growing cockerels have good free range, but the only shelter is that of the house and its eaves.

Rotating the Run

As a run-out area is desirable, the householder should take advantage of an opportunity not open to the farmer. The householder has one small poultry house, which might and should be divided into two pens, and his vegetable garden, which he usually crops on a 3-year rotation. Building the poultry house in the middle of the garden allows the three sections of crops and the poultry run to be allocated a quarter of the area each, giving these advantages: The poultry house is closer to the residence than if it were at the bottom of the garden, making for convenience in attending to the birds and lowering the cost of a path to it; the run area can be changed yearly, each area having 3 years' rest from poultry before it is used again, by which time it has been cultivated many times; and each quarter in turn is improved for gardening by being manured by the birds. Instead of permanent fencing around the run, wire netting can be stretched on wooden frames about 10ft. by 6ft., which can be moved easily and supported by stakes driven into the ground.

Disadvantages of Small Run

If a run has been made at the rear of the section in conjunction with housing which cannot be moved, the adequacy of both should be examined. If the run is too small, the vegetation is soon scratched and eaten away, the surface becomes hard packed, hollows are made for dust bathing, the ground becomes fouled, and rain-water cannot seep away readily. The result is a sea of mud in wet weather, which leads to fouling of the floor litter in the house and unclean eggs in the nests. Two small runs for alternate use are better than one larger run.

No matter what run area is given the fowls, a separate supply of greens should be grown.

Shelter and Shade

Fowls like outside conditions except in heavy or gusty winds, but, like human beings, they do not want too much direct sunshine. Hedges will provide them with shelter, and for shade one or more trees may be planted in the yard. The shade trees need not be conifers or other wood bearers. Especially if the run is rotated, fruiting or ornamental flowering trees are suitable. If they shed their leaves in autumn, that is all to the good, for winter sunshine is weak and its action on the topsoil of the run is excellent at that season. Branches overhanging to ground level are not desirable; the lower branches should be lopped off to prevent the birds perching in the tree and to permit quicker drying of the ground under it after rain.

Fowls can become lazy in hot conditions. They may feel in need of a drink, but will not bother to walk from the shade of the tree across the hot yard to the poultry house. A drinking vessel and a food hopper should be placed under the shade of the tree. Clean, cool drinking water is important, for lack of water will put a fowl off the lay far more quickly than a food shortage.

Every aspect of the poultry project should be as carefully planned as the dwelling house. The laying house should be adequate for running the total number of fowls for at least part of the year on the intensive method; the equipment should suit the feeding method used; the housing should be divided into pens if both pullets and hens will be kept; the run should be in two units to avoid fouling and allow spelling of the ground; and shelter and shade must be provided for.

When a run which is due for a spell is being dug over, deep digging is neither necessary nor desirable. Frequent and shallow digging is better, allowing the sun to shine on as many new surfaces as possible.



CROP PRODUCTION

A LARGE VOLUME of experimental work with annual crops is carried out each year by the Extension Division of the Department of Agriculture. During the 1950-51 season 166 co-operative trials were laid down on farmers' properties and 66 trials on Departmental research and demonstration farms. Some of the results from recent trials are given on this page.

MALTING BARLEY

MOST PROMISING of the Danish barley varieties in New Zealand has been found to be Kenia. A considerable number of trials has been conducted during the past 3 years comparing Kenia with standard local varieties, and the following table summarises the results:—

Variety compared with Kenia	Number of trials	Mean yield of Kenia (Bushels per acre)	Mean difference from Kenia	Number of significant differences from Kenia Higher	Lower
Golden Archer ..	36	59.8	—9.7	1	20
Spratt Archer ..	29	56.4	—14.6	Nil	21
Spratt Archer (N.I.A.B. selection) ..	17	63.9	—7.5	1	9
Research	32	58.7	—2.0	5	6

In yielding ability Kenia is definitely superior to the Archer varieties, though Research closely approaches it. From laboratory estimations Kenia has almost invariably given better malting quality than any other variety. As it is also a variety that stands well and is admirably suited to header harvesting, the growing of Kenia can be confidently recommended for the production of malting barley. This season for the first time Kenia seed of Certified origin is going on to the market for sale to farmers for crop production.

An autumn-sown trial with other Danish and Swedish varieties with characteristics somewhat similar to those of Kenia was carried out in the Marlborough district this season. These varieties had shown themselves as promising at the Crop Research Division, Department of Scientific and Industrial Research, in the previous year. The varieties tried are Herta, Maja, and Rigel (all from Denmark) and Freja and Ymer (from Sweden). Further work is planned with these varieties in the coming year.

CEREALS FOR GREENFEED

RECENT EXPERIMENTS with greenfeed cereal varieties have concerned the place of ryecorn as a greenfeed for wintering sheep. A high-quality greenfeed is valuable in helping to carry breeding ewes in good health until lambing time. Ryecorn has proved valuable for this purpose, as it is unaffected by frosts and its herbage quality is excellent at all times. Though it is somewhat slow to establish, its recovery is quicker than that of most other standard greenfeeds.

A strain of ryecorn selected by the National Institute of Agricultural Botany, England, was tried out extensively last season and proved somewhat superior in leaf production and speed of establishment to the commercial strain of ryecorn available in New Zealand. Seed of the new strain is being increased for distribution to farmers.

Winter Grey oats, a variety used extensively in South Canterbury, was investigated in that district, where it proved superior in production to all other varieties of greenfeed, including the ryecorns. As a result of this lead, the English variety Grey Winter is being imported for trial as a greenfeed oat in the coming season.

Of the other varieties tested in these greenfeed trials Wong barley has given considerable promise. Though its growth in the early stages is not as rapid as that of some other varieties tested, it recovers extremely well from repeated grazings, and this factor combined with a prostrate habit of growth is likely to make it a valuable cereal variety for grazing.

WEEDS IN CEREALS

EXPERIMENTAL RESULTS to date indicate that by the use of hormone-type weedicides most of the troublesome weeds in cereal crops can be effectively controlled or sufficiently checked in growth to allow satisfactory crop growth and appreciably increased yields. Rates of from ⅜ to 1lb. (acid equivalent) per acre are equally efficient in most instances, and unless the weed infestation is particularly severe the lower rates give satisfactory and cheaper results with less likelihood of damage to crop plants.

It is important that treatments be applied while weeds are in a young, growing stage and the crops are not more than 6in. high. Later application, especially if the crop is approaching or at the "shot"-blade stage, is likely to cause injury to the crop both by the spray material and by implement wheels. Further, young weeds are more susceptible to treatment and lower rates of application may be used satisfactorily at this stage.

VARIETIES OF WHEAT

FIELD TESTING by the Extension Division of wheat varieties bred by the Crop Research Division is an essential stage in the obtaining of improved varieties for the farmer. Varieties that have been sufficiently outstanding in a large number of field experiments to warrant their distribution to farmers are Yielder, a high-yielding wheat, and Hilgendorf, which has high baking quality.

From the 1941-42 season to the 1949-50 season 93 replicated trials included comparisons of the varieties Cross 7 and Yielder. In these trials Yielder gave statistically significant increased yields over Cross 7 in 33 experiments and on the average in 93 trials its yield was more than 5 per cent. higher than that of Cross 7.

—P. B. LYNCH

ILLUSTRATION: A South Canterbury spring-wheat variety trial.

Verticillium Wilt of Apricot, Gooseberry, Strawberry, and Tomato

By H. C. SMITH, Plant Diseases Division, Department of Scientific and Industrial Research, Auckland

VERTICILLIUM wilt, caused by the soil fungus *Verticillium dahliae*, occurs in all the important fruit-growing areas in New Zealand. During the past 10 years this disease has become of increasing importance. It was first recorded on tomato in 1933, gooseberry in 1939, apricot in 1945, and during 1949 was found on plum, peach, and strawberry. Many other plant species are known to be susceptible.

ALTHOUGH losses are at present low in New Zealand, verticillium wilt has caused severe loss to fruit crops in other parts of the world, for example in California, the Rhone Valley in France, and Niagara Peninsula in Canada.

Tomato, apricot, gooseberry, and strawberry are the main fruit crops which have been affected in New Zealand.

Outdoor tomato crops are rarely completely free from verticillium wilt infection. When tomato crops are grown a few years in succession the disease rapidly increases until all plants become infected, but with varying degrees of severity. Under some conditions the yield of infected plants is no less than that of healthy plants, but in more severe cases a reduction in yield of 50 to 80 per cent. occurs, especially in glasshouses. An estimate of the loss in yield is difficult to make, but the available evidence suggests that the loss in tomato production would be more than 5 per cent. of the whole New Zealand crop.

Losses in apricot orchards up to the present have been low—less than 1 per cent. However, unless measures are taken to reduce the spread of verticillium wilt infection, losses in the future are likely to increase steadily.

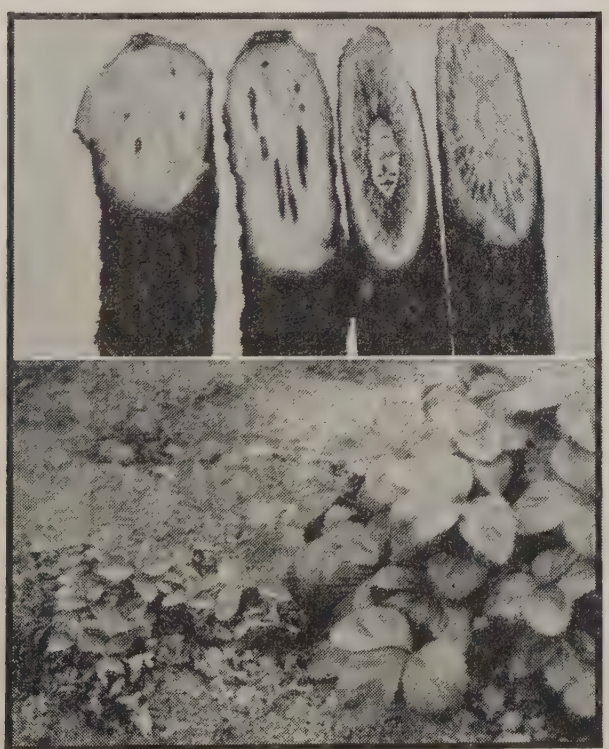


Fig. 1 (upper)—Apricot branches cut across to show black discoloration caused by verticillium wilt. Fig. 3 (lower)—Strawberry plant infected with verticillium wilt and stunted (left) and healthy plant (right).



Fig. 2—Apricot tree 11 years old infected with verticillium wilt.

Although incidence of verticillium wilt in gooseberries appears to be approximately the same in all districts, death of bushes caused by this disease is greater in Central Otago and Nelson than at Greytown or Auckland. In strawberries losses are more severe near Christchurch than at Auckland. These differences may be due to variations in climate or to differences in the strains of *Verticillium dahliae* involved. The losses in gooseberry and strawberry crops, although more serious in some seasons than others, would probably be less than 1 per cent. of the total crop.

No serious losses from verticillium wilt have yet been recorded among peach or plum trees in New Zealand.

Spread of the Fungus

With moist conditions large numbers of spores are formed from infected and decaying plant tissue in the soil. These spores are carried by water through the soil to the roots of plants, where they germinate and penetrate the root tissues. Further development of the fungus takes place in the woody tissue of susceptible plants and is dependent on the growth rate of the plant and on temperatures. With suitable temperatures, susceptible hosts, and vigorous host growth the fungus rapidly spreads through the plant. Toxins liberated by the fungus cause wilting, yellowing, and death of the leaves. With the return of infected leaves, stems, and roots to the soil the life cycle is completed. With suitable soil conditions more spores are formed ready to invade new roots.

The verticillium wilt fungus does not develop very extensively in the root systems of most hosts and does not normally reinfect the soil until the diseased plant dies. Thus the spread of the disease during the growing season is limited, as most plants are not killed quickly. As the spores of *Verticillium dahliae* are not readily airborne, it is unlikely that infection could occur through wounds on trees above ground level. Tests made on 30 leaves from infected apricot trees showed that the fungus was not present. This indicates that apricot leaves are not important in spreading the disease, although leaves from infected tomato or strawberry plants are invariably infected and probably spread infection.

Thus the main spread of the fungus must take place by the distribution of infected plants such as fat-hen, tomato, or strawberry through the soil.



Fig. 4—Tomato leaf showing wilting and yellowing caused by verticillium wilt infection.

Spread is most likely to occur during autumn or winter cultivations.

The very common weed fat-hen has been found infected with *Verticillium dahliae* in fruit-growing areas at Auckland, Greytown, Roxburgh, and Alexandra. In most of the orchards where infected fat-hen plants were found there had not been any previous crops of tomatoes.

Symptoms

With all host plants the same sequence of symptom expression is noticeable. Wilting of the leaves inward from the margins is followed by leaf yellowing. Later the leaves die and fall. Dead strawberry leaves remain attached, forming a mat of dead leaves at the base of the plant. The disease appears to attack the lower or outer leaves first, as these begin to yellow and die while the upper or inner leaves are wilting.

The severity of infection varies in different districts and in different seasons. The four main factors involved are as follows:—

1. The intensity of soil infection. Large amounts of inoculum cause more severe wilting than small amounts.
2. Growth rate of the host plant. Rapidly growing plants are usually more severely attacked than slow-growing plants.
3. Air temperature. Temperatures between 70 degrees F. and 80 degrees F. are most favourable for development of the disease.
4. Varying strains of the fungus. Cultures of *Verticillium dahliae* from Central Otago apricot trees damaged tomato plants more severely than cultures of the same fungus from egg plants grown at Auckland.

The most noticeable symptoms of verticillium wilt in four different hosts are as follows:—

Apricot: The most characteristic symptom is wilting, yellowing, and falling of the lower leaves, which leaves limbs and branches bare. Symptoms usually become evident in the late summer (see Fig. 2). Infected branches show internal brown to black discoloration of woody tissues (see Fig. 1).

Gooseberry: Premature leaf fall with some leaves remaining at the tips may occur on one or several branches. Bushes may recover or gradually die. The internal discoloration of the wood is usually darker than that in apricot branches.

Strawberry: Outer leaves collapse and die, and inner leaves are smaller and paler than normal (see Fig. 3). Veins entering the base of the leaf stems sometimes become brown.

Tomato: Stunting of infected plants, yellowing of lower leaves (see Fig. 4), and internal brown discoloration of woody tissues in the stem are the most common symptoms. Wilting is seldom seen except in glasshouses.

Known Host Range

To trace the source of infection and prevent its spread it is important to know the New Zealand host range of verticillium wilt. The following plants are known to be attacked. In each group the hosts which have been most severely affected are mentioned first.

Trees: Apricot, peach, plum, maple, lacebark (*Hoheria populnea*), and titoki (*Alectryon excelsum*).

Small fruits: Strawberry, gooseberry, raspberry, youngberry.

Field crops: Egg plant, tomato, tobacco, potato, cucumber, belladonna.

Flowers: Antirrhinum, gerbera, rose, stock (*Mathiola incana*), China aster, red flowered tobacco (*Nicotiana sanderae*), luculia, and Iceland poppy.

Weeds: Fat-hen (*Chenopodium album*), black nightshade (*Solanum nigrum*), wild tomato (*Solanum* sp.), mallow (*Malva rotundifolia*), and wild turnip (*Sinapsis arvensis*).

The host range recorded overseas is considerably wider, and it is likely that many other plant species in New Zealand are also susceptible.

Control

Verticillium wilt is difficult to control because the infection is soil borne and the fungus develops within the woody tissues of infected plants. At present the only method of curing infected plants is by hot-water treatment (110 degrees F. for 30 minutes). This method, however, is of limited value, being suitable only for plants such as strawberry runners and gooseberry cuttings.

In the propagation of strawberries and gooseberries, runners or cuttings should be taken only from the most vigorous plants which show no symptoms of infection. There is no evidence that young trees of apricot, plum, or peach have been infected with verticillium wilt in the nursery, although this could occur. With tomatoes infection is not seed carried, but seedlings may be infected in the boxes if grown in infected soil.

With all crops the best method of reducing the incidence of verticillium wilt is by reducing soil infection. Several practices are recommended:—

1. Clean cultivation to prevent the growth of susceptible weeds or cover cropping with cereals, grass, or clover.
2. Avoid intercropping susceptible orchard crops with other susceptible crops; for example, do not grow tomatoes, strawberries, or egg plants between stone-fruit trees. Although these crops may not introduce infection, they will cause a rapid build up of *Verticillium dahliae* should there be any of this fungus present.
3. Soil sterilisation with steam, formalin, or chloropicrin in glasshouses. A circle about 5ft. in radius round the fruit tree site should be treated with formalin or chloropicrin before susceptible trees are replanted in infected soil.
4. Sowing down heavily infected areas in grass for 2 or 3 years before replanting to susceptible crops or replanting with more resistant crops such as apple, pear, quince, or cherry rather than with apricot, peach, or plum.
5. When an annual crop develops infection remove as much of the plant remains as possible.

Feeding of Sheep in Canterbury

TO the store of practical knowledge of sheep feeding which has accumulated through a century of farming in Canterbury has been added the results of experimental work carried out during the past 10 years by the Department of Agriculture and Canterbury Agricultural College, Lincoln, at the Kirwee experimental farm and at the college. This is the concluding section of an article by I. E. Coop, Professor of Animal Husbandry, Canterbury Agricultural College, in which an attempt has been made to weld together information from the two sources. It deals principally with the fattening of weaned lambs and the rearing of ewe hoggets; the first section, in last month's "Journal", discussed the the feeding of breeding ewes.

CANTERBURY has a balanced and well-developed sheep industry based on store-sheep production on the hill country and fat-lamb production on the plains. In this article particular reference is made to the feeding of sheep on the cropping plus fat-lamb farms typical of the Canterbury Plains.

Fattening Weaned Lambs

In Canterbury the average proportion of "milk" lambs drafted fat off the ewes on the fat-lamb farms is 30 to 50 per cent. The remainder must be weaned and finished off on some specially saved or grown feed. To this number of weaned lambs by fat-lamb sires must be added the store half-bred, Corriedale, and Romney wether lambs which come off the store-sheep hill country. A total of some 2,000,000 lambs must be fattened on feed from January to May.

The best time at which to wean lambs depends on a number of factors. Probably the most important is the time at which the grown crops such as rape are ready to be grazed, which can vary greatly according to the season and may be as soon as 8 weeks after sowing in a very dry spring, or as late as several months after in a wet summer. A second important factor is the thrift of the lambs while on the mothers, which is determined largely by the feed and the milk supply of the ewes. When the growth rate of the lambs has begun to slacken noticeably is the time to draft off the fats to prevent their losing weight and "bloom" and to save what good feed is left for the remaining lambs. As seasonal conditions cannot be foretold accurately, such procedures can seldom be timed with precision, so dates of drafting and weaning can be decided only after consideration of the situation on the farm in question at the time. In general, weaning begins in December in districts where the seasons and the lambing are early and runs through to the beginning of February in the late foothill country. It coincides approximately with the time when pastures have dried and browned off, leaving little or no green and leafy pasture capable of sustaining growth in the lambs.

As a consequence it becomes essential to grow special succulent crops such as rape, which will be of high food value during these months of January to March when pasture value is low. As a limited alternative, advantage may be taken of such feeds as lucerne, hay and seeds aftermath, and cereal stubbles.

Immediately after weaning it is necessary to crutch the lambs, as the crops on which they are to be fed are succulent and rather laxative and may cause uncrutched lambs to become dirty and susceptible to fly-strike. If the lambs are badly infested with keds, as store lambs off the hills sometimes are, dipping them would also pay.

Experiments at Kirwee and the experience of many farmers have shown that lambs should be put on the best pasture available for about a week before they are put on to rape. By this means the check in growth rate at weaning is minimised and some of the rape is saved. If lambs are placed on rape immediately after being weaned, they do not begin to put on weight until after 1 or 2 weeks later, whereas if they are first put on pasture, they seem to restart growth as soon as they are placed on the rape.

Rape for Weaned Lambs

Rape should be sown in breaks according to the period for which it is proposed to carry the lambs. If finishing off the farm's own lambs is all that is intended, one sowing is probably sufficient, but if it is proposed to fatten lambs over a period of, say, 6 to 10 weeks, the rape should be sown in breaks sufficient to allow about 3 weeks' feeding per break.

At Kirwee the Department of Agriculture carried out an extensive series of trials designed to determine the best method of using feed such as rape or lupins. The conclusions drawn are applicable to the light and medium-light soils and dry summers such as are common at Kirwee. On the heavier and wetter country there may be factors modifying these conclusions.

Methods of Grazing Rape

Set grazing of the whole break continuously until it is eaten out was compared with the grazing of a succession of small breaks, or "folding", as it is termed in England. For the second method the whole break was subdivided into smaller ones each capable of feeding the lambs for 1 week and in subsequent trials for only 1 or 2 days. The lambs were thus shifted on to clean feed at more rapid intervals. In theory this should have given better utilisation and greater liveweight gain per acre. In practice it was comparable to set grazing but no better, and the set-grazing method required less labour.

Presumably the dry conditions which prevail in Canterbury at this season can cause just as rapid deterioration in the saved ungrazed breaks as the lambs cause in the large breaks. It is not uncommon in Canterbury for a crop of rape to be withered or blown out of the paddock within about a



[*Canterbury Agricultural College photo.*

Chou moellier has a high carrying capacity and will stand above snow. In this illustration it is being fed to hoggets.

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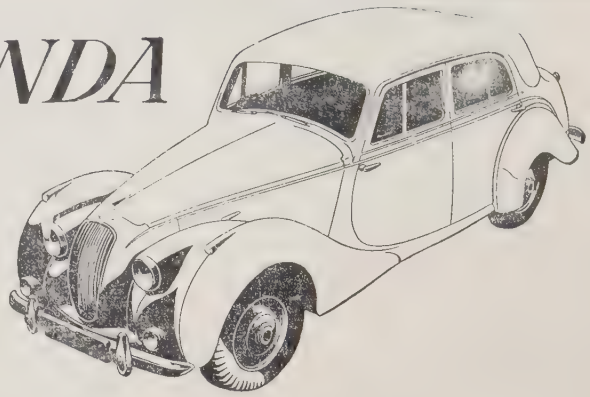
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week of it reaching the grazing stage. In such circumstances best utilisation probably cannot be achieved in a planned system of small-break grazing.

Whatever the system adopted, it is important to move the lambs on to the next break as soon as the existing one is eaten out. For greatest economy lambs should be fattened as fast as possible, so anything likely to give them a check must be avoided.

Run-off with Rape

The value of a run-off depends entirely on the quality of the pasture in the run-off. In a wet summer when the run-off may contain green leafy grasses and clovers the rate of growth of lambs given the run-off can be as high as that of those on rape alone, and the net result is that more lambs can be fattened.

However, in a normal Canterbury season the run-off consists of nothing but withered, stalky pasture, which is of no value. Time spent on such a run-off is merely time spent not eating rape. The growth rate of the lambs is reduced, and because of the transient nature of a crop of rape it does not then pay to give the lambs a run-off.

Other Supplements to Rape

As rape is very succulent and tends to cause scouring, the idea of balancing the diet with dry feed such as hay or grain has often been attractive. However, experiments at Kirwee have shown that little is to be gained from this. Rate of liveweight gain is not increased—in fact, it is likely to be reduced—probably because the hay or grain eaten brings about a corresponding reduction in the amount of rape eaten. As the hay or grain is not of higher food value than rape, and as its dryness appears to have no virtue in itself, the growth rate of the lambs is not enhanced.

On the other hand, the hay or grain does have a rape-sparing effect, so that under certain conditions 30 to 40 per cent. more lambs can be fattened, depending to a large extent on the quality of the supplement used and on the influence of climate on the period during which the rape can be grazed.

Drenching of Lambs on Rape

The drenching of lambs with bluestone and nicotine, and after 1941 with phenothiazine, was also studied for its effect on both the degree of worm infestation of the lambs and the rate of liveweight increase.

Invariably drenching reduced the level of worm infestation, but only in the years when this level was high was the reduction reflected in an improvement in liveweight gain of the lambs. In other words, a mild degree of infestation does not harm lambs and only when it reaches certain levels do prophylactic measures such as drenching have any beneficial effect. These levels were reached in the years of wet summers. The worm infestation usually declined markedly after the middle of March, so even where drenching is adopted it need not be carried beyond about the beginning of March. Wet summers with humid conditions favouring rapid development of the worm cycle are also conducive to the growth of clover and weed undercover, which, in contrast to erect crops, allows reinfestation of the lambs by worm larvae from the droppings.

In short, lambs need not be drenched at all during a normal dry Canterbury summer, at least on the light land such as at Kirwee and Ashley Dene. Only in the occasional wet summer is drenching likely to confer any benefit. In these circumstances phenothiazine should be given a day or so before the lambs go on the rape, with possibly another dose later, depending on the season and the thrift of the lambs.

In a wet season feeding in weekly breaks instead of 3-weekly breaks is likely to help interrupt the worm cycle.

Maturity of Rape

While rape is growing it is highly succulent and can cause both scalding and severe scouring in lambs. Therefore lambs should not be put on rape until it has matured, which is indicated by the development of a purplish or reddish tinge on the leaves. In a wet summer rape may continue to grow and never reach this desirable stage; such rape seldom fattens lambs well.

Experience at Kirwee has shown that, contrary to expectation, lambs grow and fatten fastest in hot, dry weather when the rape is brittle or wilted and has, to a human being at least, an unappetising appearance.

Provision of Water with Rape

With break grazing and no run-off, providing the lambs with water is not always easy. As long as rape is succulent and not wilted or withered it contains sufficient moisture for the lambs, so water need not be provided specially. As soon as the rape withers and becomes rather brittle the lambs look for water, and then they should be given access to it.

Area of Rape

Several factors should be considered in deciding the area of rape to be sown.

Apart from how rape fits into the general cropping programme, the first consideration is the number and condition of the lambs to be fattened. For 10 years at Kirwee the rate of liveweight increase of lambs on rape has varied from 1 to 3½lb. per week, with an average of 2½lb. Southdown-cross feeder lambs can be drafted fat as soon as they reach a weight of 65 to 70lb., so if finishing off forward stores of 55 to 60lb. liveweight is all that is required, it can be done in 4 to 5 weeks. Only one break need be grown and the farmer can expect to fatten an average of about 20 lambs per acre.

On the other hand, if stores of liveweight of about 50lb. are to be bought off hill country, or if the farm's lambs are to be carried to 36lb. carcass weight (75lb. liveweight), obviously much more time will be needed—probably 8 to 10 weeks—and probably an acre of rape will fatten only 10 to 12 lambs.

If the growth of rape is better than was expected, either more lambs can be fattened or they may be taken to higher weights, and the reverse holds if the crop is poorer than was expected.

Lupins as Lamb Feed

During the past decade increasing use has been made of lupins as a lamb-fattening feed, though this increase has now slowed down considerably and the total area in lupins for lamb fattening is unlikely to equal that in rape. Though ewes will eat bitter lupins readily after a short period of becoming accustomed to them, the sweet varieties must be used for lambs, as the growth rate must be rapid and that is not possible unless the lambs are eating eagerly.

Trials at Kirwee have shown sweet blue lupins to be comparable to rape in the rate at which they fatten lambs and in the number per acre they will fatten. However, lupins tend to mature rapidly, so the time available for feeding before they become very woody and develop pods is shorter than with rape. Results of the experiments in methods of utilisation of rape have been found to apply equally to lupins.

The main limitations to greater use of lupins are the high cost of the seed and the difficulty of growing them satisfactorily under many conditions.

Kale and Chou Moellier

Some medium-stemmed chou moellier and thousand-headed kale has been grown for fattening lambs. These two crops were tried at Kirwee for 2 years and in very dry summers they compared very favourably with rape. The rate of fattening the lambs was slightly slower than that of rape, but the crops yielded much better, were more resistant to drought and insects, and fattened 50 per cent. more lambs per acre. However, under somewhat similar climatic conditions at Ashley Dene (Canterbury Agricultural College's farm on light land) chou moellier and kale did not produce as well as rape.

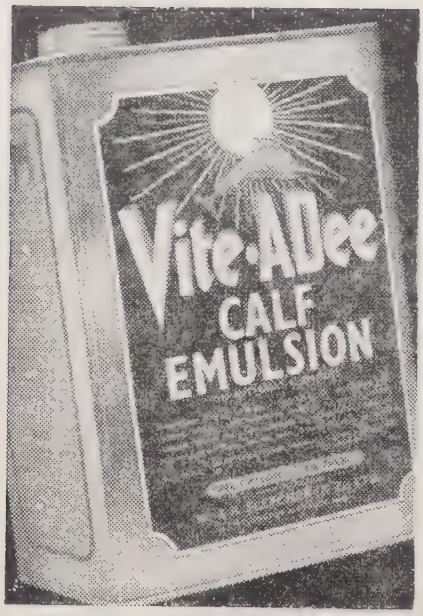
Perhaps the limited knowledge on this subject can best be summarised by saying that rape, lupins, chou moellier, and kale all have feeding values and rate-of-fattening values which are very much alike and that the best of these crops to grow in any district or on any farm is that which consistently gives the highest yield per acre.

Mixed Crops for Lamb Feed

Not uncommonly, mixed crops such as rape and turnips, rape and Italian ryegrass, and rape and lupins are grown on the grounds either that a mixed diet will fatten lambs better than a diet of rape alone or that, if the season is bad for rape, at least it may not be so unfavourable for the other crop. It is difficult to say whether in the long run this system has advantages.

Other Lamb-fattening Feeds

Advantage is sometimes taken, according to the type of farm and the circumstances, of opportunity to finish off weaned lambs on wheat stubble and hay and small-seeds aftermath. Though such feeding is unlikely to be prolonged, forward lambs can be finished off by this method without the necessity for growing special fattening crops.



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[*Canterbury Agricultural College photo.*

Turnips are best fed in breaks, hoggets being put on the new break until the tops are eaten as in the foreground of this illustration, and the breeding ewes then brought in.

Lambs have been fattened satisfactorily on lucerne at both Kirwee and Ashley Dene, though at a somewhat slower rate than on rape, and this appears to be the general experience of farmers also. On very light land, such as at Ashley Dene, where summer forage crops are extremely unreliable, increasing attention may well be given to lucerne in this role.

Pasture can be used to fatten lambs if it is green and leafy, but it seldom is in Canterbury. In the few years when good green pasture was available at Kirwee and Ashley Dene at this season, the rate of fattening of weaned lambs on pasture was considerably slower than that of lambs on grown crops. Nevertheless the increasing use of irrigation or of special-purpose pastures containing such species as red clover or lucerne will no doubt slowly diminish the necessity to grow forage crops.

Feeding of Hoggets

Except on the larger farms ewe hoggets for replacements are not generally carried on the Canterbury Plains. Most of the hoggets are reared on the surrounding hill country. However, some farmers rear their own replacements, and along the foothills ewe hoggets are often wintered on the flatter arable country. For several years at Kirwee and subsequently at Ashley Dene the nutrition and growth of hoggets have been the subject of trials and observations, especially during winter. The following is an outline of the deductions which have been made from these trials.

After being weaned the ewe lambs to be retained as replacements should be drafted off into a separate mob and crutched. After the lambs which are going on to such a crop as rape for fattening, these ewe lambs should have preference of feed supply. It is fairly important that a steady growth rate be maintained so that the hoggets do not receive a severe check at any time. Steady growth, especially during autumn and winter, helps to overcome two of the hazards of hogget rearing—poor thrift and worm infestation in late summer and autumn, and malnutrition during winter when the feed supply is sometimes short. The experience has been that once the winter is over no further difficulties arise with hoggets. With the improved grass growth and warmer weather in spring and early summer the hoggets grow very rapidly. Even if they have been subjected to severe treatment previously and are stunted at the end of winter, they make remarkable recovery.

Maintenance of a steady growth rate also leads to the production of a hogget or 2-tooth with more size, much better conformation, and a fleece 1 to 2lb. heavier than those of animals which have a hard winter. These are temporary advantages, as at the 4-tooth stage it is very difficult to determine how the ewes were reared as hoggets. Where the more desirable conformation has sales value (as in the sale of cull 2-tooth ewes), this and the extra wool suggest that looking after the hoggets carefully to maintain a steady growth rate is profitable.

Drenching of Hoggets

Throughout the past 10 years the degree of worm infestation and the response to drenching have been measured initially at Kirwee and subsequently at Ashley Dene. The degree of worm infestation, with the exception of two instances, has remained remarkably low. The two exceptions were in 1943 and in the autumn of 1947.

In 1947 the lambs had been kept for experimental purposes heavily stocked on the same paddock in which they were weaned, a practice to be deprecated strongly. Moist, humid conditions in April caused a flare-up of worm infestation, with loss of weight and some deaths in the lambs. This was quickly controlled by either or preferably both of two methods—shifting the lambs to clean pasture or drenching them with phenothiazine. As the winter set in worm infestation declined to below a dangerous level even in the untreated lambs.

In all other circumstances worm infestation has been at a low level and drenching has been without effect. Therefore it is clear that on the lighter and drier land of Canterbury drenching need be used only in exceptional seasons; that is, when warm, moist conditions in late summer and autumn lead to scouring and poor thrift in the lambs.

No measurements or trials were conducted on the heavier land or on the wetter foothill country. On such country the responses to drenching might be expected to be more frequent than

were obtained at Kirwee and Ashley Dene, but even so it is likely that a lot of unnecessary drenching is done.

Though drenching can pay very handsome dividends when the level of worm infestation is high, too often drenching is considered routine irrespective of what benefit, if any, is obtained. Proper management, not drenching, in most cases is the key to maintaining health and growth.

Winter Feeding of Hoggets

After hoggets have been grazed on the best of the pasture during summer and autumn they must be kept growing on supplementary feed during winter when pasture growth is at a standstill. For this purpose, as for the feeding of breeding ewes, common feeds grown are hay, chaff, turnips, chou moellier, and greenfeed.

At Kirwee trials were conducted to determine whether any of these feeds could account for poor thrift in hoggets when fed as the sole ration. Groups of hoggets were maintained on turnips, chou moellier, and greenfeed separately and also on each supplemented with hay. The hoggets were found to grow equally well on all these feeds, increasing in weight by 15 to 25lb. during the 3 winter months. All the feeds gave very much better results than permanent pasture.

Feeding the crops in weekly breaks with the object of minimising worm infestation was without effect, a result not surprising in view of the low level which persisted everywhere throughout the trials. The effect of providing a run-off was to reduce the rate of weight gain, probably through less of the crop being eaten, though no doubt more hoggets could have been carried per acre of crop. Throughout the trials the effect of offering hay with the crop was to cause a saving of crop; that is, more hoggets could be carried per acre without any increase in the rate of weight gain. About ½lb. of hay per head per day was the average amount eaten.

Rickets was observed to develop in about one year in two when hoggets were wintered continuously on greenfeed alone. The disease manifests itself as a lameness which usually develops about July when the hoggets have been 6 to 8 weeks on the greenfeed. In addition, the hoggets cease to grow rapidly, this reduced rate of growth usually beginning before visible signs of lameness occur. Rickets and the associated decline in growth rate can be prevented by giving one dose of calciferol (vitamin D) at the beginning of winter. This drench is available commercially. Prevention can also be effected by a hay supplement or by not feeding the greenfeed continuously. The severity of rickets is greatest on greenfeed oats and barley, less on Italian ryegrass, and least on pasture.

Winter Management of Hoggets

The results of the continued feeding of hoggets on certain crops have been given, but it is not suggested that such a practice is to be recommended on commercial farms. A diversified diet is generally to be preferred.

Before the hoggets are put on to supplementary crops they should be crutched and eye-clipped; in fact, this should be done in May or June whatever the feeding system is.

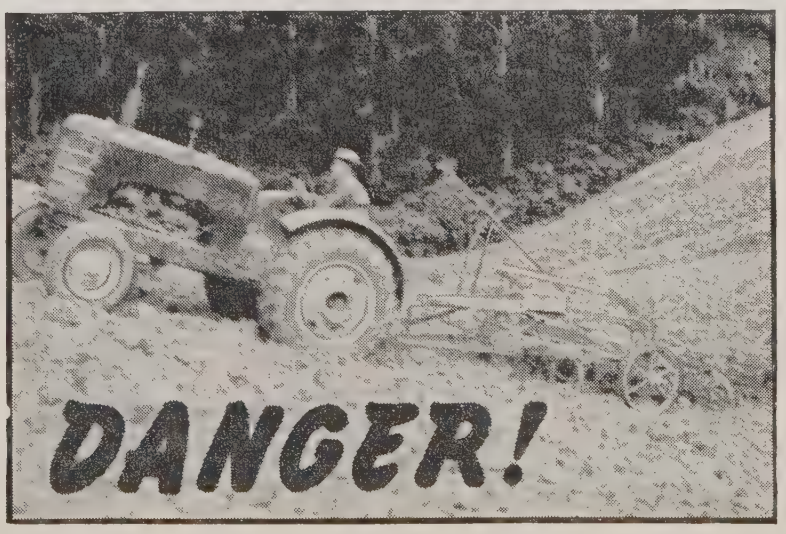
Turnips play a large part in the feeding of hoggets in Canterbury, and it is advisable to feed out hay, preferably lucerne hay, in racks at the same time. This not only gives a mixed diet, but makes the turnips or the hay go further. In other words, feeding turnips and hay for 8 weeks is preferable to feeding turnips alone for 4 weeks and hay alone for 4 weeks.

Break grazing of turnips is also advantageous, hoggets being put on the new break until the tops are eaten and the breeding ewes then brought in. The reasons are, first, that the best part of the turnip is the leafy top and the growing hoggets should have the best, and, second, that because of their failing milk teeth hoggets do nor scar the turnip bulbs severely and rotting of the bulb is minimised. In Southland hoggets' teeth are cut with pliers for the latter reason. As the eating of turnips and swedes is hard on teeth, especially in hoggets when the milk teeth are failing and the first two permanents are soon to erupt, it is advisable to keep a close watch on the mouths of the animals.

When chou moellier or greenfeed is fed, hay should also be provided as a supplement if possible for the same reasons as have just been given. Furthermore, hoggets should receive good-quality hay, as they are more selective eaters than older sheep. Greenfeed in the main should be reserved as lambing feed for the ewes, their need at that time being much greater than that of the hoggets. If possible, ewes should be taken off turnips and chou moellier at lambing time and, assuming that all the available greenfeed is reserved for them thenceforth, the hoggets can well be usd to finish off through August and September any turnips or chou moellier which remain.

In such a system the hoggets will receive during winter considerable amounts of turnips and hay, or chou moellier and hay (as both turnips and chou moellier are seldom grown on the same farm), with some pasture and an occasional light grazing of greenfeed. This should ensure a reasonably balanced diet and maintain a good rate of growth.

When lambing begins in spring first priority in the feed supply naturally must be given to the ewes and lambs. The hoggets can then be put away on some reasonably good feed. Apart from the dangers of fly-strike from December to February, they require little attention for the remainder of the year. Rapid growth will be made during this period and, provided they have been cared for reasonably well previously, the hoggets will develop into well-grown 2-tooths.



TRACTORS are now the main means of providing power to cultivate land in New Zealand, but as horses and bullocks become increasingly outmoded new operators of tractors must be warned of the dangers involved. The most important causes of accidents are faulty judgment, carelessness, and thoughtlessness.

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Using a snig chain to allow the tractor to clear holes, hollows, or ditches.

Adding weights to front wheels or fore carriage, or filling the front tubes with water.

Not attempting to work impossible places. The tractor illustrated is digging in with little weight on the front wheels, and a sudden clutch engagement in such circumstances could mean disaster.

—J. N. M. WHYTE, Farm Machinery Instructor,
Department of Agriculture, Dunedin

Establishing an Asparagus Field

ASPARAGUS is rather a costly crop to establish, but one that soon repays a little extra time, care, and expenditure in the preparation of the land, planting, and attention before production is reached. Misses in the first year are difficult to replace, and if gaps are left, a reduction in crop must be expected. Methods used to ensure satisfactory establishment of an asparagus field are the subject of this article by R. I. June, Orchard Instructor, Department of Agriculture, Hastings.

IF the topsoil is reasonably deep, asparagus will thrive on a wide range of soils. Shallow soils with hard subsoils are not suitable. Deep, free loams are best, but peat or light, sandy loams may also produce good crops. On a very light, sandy soil production may not be heavy and the harvesting season is shorter, but it may have the advantage of being earlier, thus commanding better prices if the crop is grown for the open market. Early maturity offers no advantage where the crop is grown for canning.



Ten-month-old Mary Washington asparagus seedlings of a good, strong type suitable for planting.

Preparation of the Land

The best possible soil conditions should be obtained before planting, as asparagus plants will produce profitably for 20 to 25 years or more, and under ideal conditions profitable crops are produced for almost twice this period.

The incorporation of organic matter is most important. Cover crops with ample bulk can be grown the season before planting to supply this material. Land that has been in grass provides a good supply of humus, but even then a bulky crop such as blue lupin or grain could be grown to advantage after the grass has been worked in. Organic matter in the form of cover crops is difficult to supply once the asparagus is established, though some cover crops can be grown between rows. Fern growth should never be cut and carried off or burnt, but should always be disced in when it has turned yellow. Change of the fern from its normal green to a yellow tinge is a sign that it has completed its function of building up the storage of food in the root system ready for the next season's growth.

Removing or burning the fern growth destroys much useful organic matter which in time would provide humus to the soil. Seedlings that develop from ripened berries can be controlled by proper cultivation.

Soil should be well drained, but asparagus will tolerate a reasonable amount of water if it does not lie for too long. In some areas production is better in low-lying patches where water lies for short periods in heavy rains than in surrounding parts, but that may be the result of a more plentiful supply of moisture during spring and summer rather than of poor drainage and waterlogged conditions.

Land should be free from troublesome grasses and weeds such as couch, doub, convolvulus, and any tap-rooted weeds such as dock. Eradication of most of these troublesome weeds is impossible once they are established in an asparagus bed; in fact, they are spread from year to year by cultivation. Dock, convolvulus, and other broad-leaved weeds can be controlled by the application of hormone weed-killers at the end of the cutting season just before asparagus fern growth is allowed to develop.

If the land has previously been in grass, it should either be skim ploughed or disced before deep ploughing to assist the sod to break down. The first deep ploughing should be 8 or 9in. deep to keep the sod reasonably near the surface, where micro-organisms that turn it into humus are most plentiful. A second ploughing before planting, up to 12in. deep according to the depth of topsoil, loosens the soil below the level at which the crown is to be planted and assists root penetration. It also turns under the rich topsoil to where the first root development will be, assisting the crowns to get a good start. An asparagus crown cannot become established quickly if it is planted in a cold subsoil devoid of humus, air, and soil microbes.

The land can then be disced to level it and obtain a reasonable tilth. The final ploughing should not be given so long before planting that the soil has time to consolidate, but the first ploughing should be done in ample time to allow the green material and roots to break down thoroughly.

Planting the Crowns

One-year-old crowns are recommended for commercial plantings. Those left in the seed-bed for 2 years are often poorly developed through having been too crowded; roots become intertwined and difficult to separate, digging is much slower and more difficult, and more damage is done to roots in lifting them. Asparagus roots are very thick and fleshy and are very easily damaged. Little is gained by planting 2-year-old crowns, and the cost of the plants is much greater.

In the North Island asparagus is usually planted in August, but later planting is quite satisfactory. Soil conditions often govern the time of planting to a great extent, as planting while the soil is very wet is not advisable.

Depth of planting must be varied to some extent according to the type and depth of soil. In a deep, loose loam 8in. is recommended. In a light, sandy loam a little deeper would be advisable if the soil tends to dry out badly in summer. In heavy or very shallow soils 8in. may be so deep as to reduce yields and as shallow a planting depth as 6in. may have to be adopted; moulding up over the row would then be necessary to prevent damage to the crown in cultivation.

The crown must be planted in soil that is rich in plant foods. Therefore placing it in lifeless subsoil just to get the crown out of the way of cultivation is useless, and planting depths must be varied accordingly.

Planting distances also vary slightly in different localities, but rows are usually 6ft. apart and the minimum distance is considered to be 5ft. 6in. An asparagus plant dug up on a deep, free silt loam in Hawkes Bay had a spread of more than 8ft. and other roots were still growing downward at a depth of 4ft. This plant was at the end of a row, so roots from other plants would not have interfered with its growth, and possibly it had developed more than those planted further along the row; nevertheless it indicates the extent to which the root system of an asparagus plant can develop. The roots would soon spread across a 6ft. row, and if plants are set much closer they cannot yield so well or produce for so long. The most satisfactory distance between plants in the row seems to be about 1ft. 6in. If the rows are closer than 6ft., the distance between plants should be extended.

Planting 6ft. by 1ft. 6in. requires about 4800 plants per acre. One-year-old crowns have been selling at £3 to £4 per 1000 for reasonably large quantities during the past year or two.

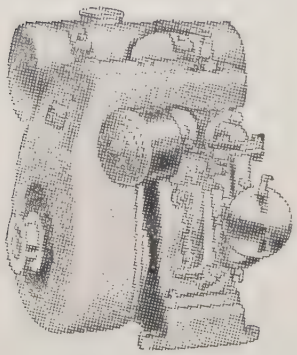
The furrow in which the plants are placed should be made 2 to 3in. deeper than the level at which the crowns will be when they have been planted. The roots then have loose soil under them for easier root establishment, though the main root growth is outward from the crown. Making the furrow deeper allows for some topsoil to fall or be pulled down into the furrow and the crown may be set on this. It also allows ample depth in places where the furrow may vary.

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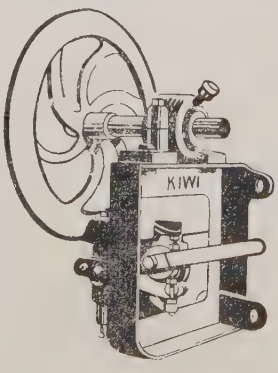


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Striking out the furrows too far ahead of planting is not advisable. Planting should be done immediately while the soil is moist and easily worked. Soil that becomes lumpy through exposure will not settle well around the roots, and is the cause of many plants failing to become established.

In some cases—for instance, if a contractor has to be hired—it may not be possible to plant while the soil is still moist. If the soil is dried out by wind or exposure and becomes difficult to handle, a shovelful of moist soil should be placed over each crown and around the roots to ensure that the plant does not become dried out. In normal conditions a hoe or trowel should be used to pull the desired amount of soil from the side of the trench over the plant, and this should be well firmed by treading on either side of the plant. Covering by hand is preferred to mechanical coverage, because it allows individual attention to be given to each plant. If the plants are covered by discs or some other implement, a very close inspection should be made afterward to ensure that no plants are exposed. However, the depth to which they have been covered cannot be observed, and if the land is rather uneven, some plants may be smothered.

The crowns should be covered to a depth of 2in. or a little more at planting time. If covered too deeply at first, they tend to be smothered. It is not natural for plants to thrive at a great depth, and the main reason for such deep planting is to avoid the crowns becoming damaged during cutting and cultivating. Small crowns tend to be smothered more easily, and weak ones should be discarded as they are noticed.



Potatoes are one crop which can be used for intercropping in an asparagus field, but they should not be of a variety with very vigorous top growth.

Everything possible should be done to ensure a perfect strike in the first year, as gaps mean a reduction in yield and are very difficult to fill in the second year. Therefore a little added care and expense at first planting are well repaid.

If a few plants fail to grow after all reasonable care has been taken, they can sometimes be replaced successfully as soon as failure of the fern to appear indicates the gaps. Replacement should not be attempted too soon, however, as some plants may take much longer than others to start into growth. A few crowns can be heeled in for this purpose and set out in November or early December. Conditions must be reasonably satisfactory for this to be successful, but even if the replacements do not all grow, misses are at least reduced and the subsequent production level raised.

The trench is filled in an inch or two at a time after the fern has developed to a few inches high. This should smother the weeds enough to keep them in check. If the area is particularly weedy, hand hoeing may also be necessary. By midsummer the bed should be level. When the foliage becomes yellow the whole area can be disced.



[*R. W. Orr photo.*

The rows on the left have very few gaps, but those on the right show the result of poor work by inexperienced planters. This part of the area had to be worked up again and replanted the following year. A year's production and the cost of the work put into the land were lost. Dwarf tomatoes were interplanted, but cultivation was difficult.

Intercropping

Though intercropping is not recommended for the benefit of the asparagus, few growers can afford not to make use of the land while the asparagus is not bearing. With careful choice of crops, more care in cultivation, and allowance for the extra crop in fertilising, intercropping can be done with little detriment to the asparagus.

Intercropping interferes with the filling in of the trench, making more hand work necessary in the first season, and in the second season the fern growth is fairly considerable, making the choice of crops difficult. If potatoes are grown, they should be of a variety of which the top growth is not too vigorous. Tomatoes have often been used. In small areas crops such as lettuce, low-growing peas, beans, or early cabbage may be more suitable.

Weed Control

If the soil is suitable and planting has been done thoroughly, weed control is the grower's main concern. From the time the seed-bed is formed

weeds must not be allowed to develop to a great extent. The only time they can be tolerated is late in the season on a mature bed when harvesting has been completed, and even then they should not be allowed to seed.

When the crowns have been planted in the trench filling in helps to control weeds. In the second year it is more difficult, as the land is then level. Either earth must be thrown up to smother the weeds or considerable hand work done. Earthing up is limited, because the crown should not be covered too deeply in the second year. A last shallow cultivation can be made as late as possible before the first growth appears above the surface.

Chemical weedkillers have made weed control during the establishment period much easier. D.N.O.C. (dinitro-ortho-cresol) can be applied to fern growth without harm, but cannot be applied after the seed-bed and establishment period, as it causes damage to spears. The chemical is used at a strength of 1 part in 80 of water, which gives good control of most weeds if it is applied before they have developed enough to become woody. If the weeds have been allowed to reach that stage, the dilution can be as low as 1 in 60 without harm to the asparagus.

Calcium cyanamide, a fertiliser containing 21 per cent. of nitrogen, has been used successfully overseas as a weedkiller. It would be used chiefly in mature beds. This fertiliser is applied in strips along the row when cutting time approaches at the rate of 250lb. per acre on light, sandy soils to 500lb. per acre on heavy soils.

Asparagus is tolerant of salt, but there is little evidence to show that salt is very beneficial as a fertiliser. It is used mainly to control weeds, but such large quantities are needed that commercial growers in New Zealand do not use it to a great extent. Its application does not assist establishment as far as is known.

Fertilisers and Lime

Hard-and-fast recommendations for fertiliser applications in asparagus establishment cannot be made because of variations in soils and their degree of fertility, but lime requirements can be stated more definitely. Asparagus prefers a slightly acid soil, but will thrive in a neutral or a slightly alkaline one. If the soil is fairly alkaline, it may be wise to use a fertiliser which will tend to reduce its alkalinity, such as sulphate of ammonia, to supply nitrogen requirements. Lime should be applied to a sour soil to bring the pH up to at least 6. Soil with a pH of between 6 and 6.8 appears to be most satisfactory.

Other fertilisers should be applied to assure good growth so that the crown will build up as quickly as possible. Nitrogen supplies should be maintained at a fairly high level, with phosphates and potash to keep the balance satisfactory.

Raising of Seedlings

Some growers obtain plants from nurserymen, but others prefer to raise their own. If a substantial number is required, growing his own plants offers advantages to the grower: The plants are cheaper, they are available exactly when they are required for planting, and they can be planted as soon as they have been dug. Seed should be saved from a reliable source and a selection made from vigorous plants.

Seeds saved from mature, bright-red fruit should be planted in well-prepared and fertile soil in early spring and the seedlings allowed to grow there until the following spring, when they are ready to plant out. The seed should be planted about 1in. deep in most soils and a little deeper in light, sandy soils in rows 18 to 24in. apart. A mechanical planter gives better spacing; if seeds are planted by hand, two may fall close together, resulting in two crowns growing into each other, which prevents proper development and makes separation slow at digging time. As thinning asparagus seedlings is difficult, the seed should be spaced 3 to 4in. apart.

Cultivation at frequent intervals is necessary to control weeds, but deep cultivation is not needed and may damage the tender and fleshy roots. If a chemical weedkiller is used, cultivation need not be so frequent.

Asparagus seeds are rather slow to germinate, taking 2 to 4 weeks or more according to soil temperature, moisture conditions, and depth of planting. Soaking will speed up germination, but the seed should be spread to dry on the surface before being planted and should be planted soon after it has dried to avoid loss of vitality. The percentage of germination of asparagus seed is often fairly low. With spacing in the permanent bed of 6ft. by 18in., requiring 4480 plants per acre, 8 to 9lb. of seed is sufficient to establish approximately 25 acres.

The crowns can be lifted with forks and the earth shaken off them at the same time, but it is better to plough them out first to free them and then shake the earth off with a fork. Using the plough is much quicker and less likely to damage the roots. When the crowns have been dug they should be kept covered so that they will not dry out.

Varieties

In the past the varieties most favoured have been Mary Washington and Connovers Colossal. Paradise, a more recent introduction, has now been grown long enough to prove that its production considerably exceeds that of the older-established varieties. Other varieties have been established, but their quality and cropping ability cannot yet be compared with those of present varieties.

Use of Wire Netting to Protect Silage Stack



[*Desgranges Studios photo.*

A NOVEL method of protecting a silage stack by using T irons and wire netting is illustrated above.

The T irons are lightly driven into the ground hard up against the stack. A wire is run through the bottom hole of the T iron and strained. Two lengths of 4in.-mesh sheep netting are then wrapped around the stack, with the overlap where stack are most likely to attempt to pull at the stack. The netting can be attached to the T irons at ground level to prevent its being lifted by stock, and if necessary, a peg can be driven in between the T irons for the same purpose.

Mr. J. Ormsby, of Te Kuiti, who uses this method of stack protection, does not feed out the silage in the field in which the stack is. He removes the fence and carts the silage into other fields for feeding, thereby preventing pugging of the land by stock accumulating around the stack.

All silage stacks on the farm are treated in the same way, so that ultimately all fields are fed over. After a stack has been fed out the netting is carefully rolled up and stored with the T irons ready for the next season.

—K. M. MONTGOMERY, Fields Instructor,
Department of Agriculture, Te Kuiti

POISONOUS PLANTS IN NEW ZEALAND

THIS is the eleventh section of a series of descriptions of poisonous plants which grow in New Zealand by H. E. Connor, Botanist, Department of Scientific and Industrial Research, Wellington. The series is appearing monthly in the "Journal", and glossaries to be used with the series were published with the first section, which appeared in the October, 1950, issue.



Fig. 23—A: Broomcorn millet (*Panicum miliaceum*). B (habit) and C (plant with capsules) of cape tulip (*Homeria collina*).

MONOCOTYLEDONS

Iridaceae

One-leaved Cape Tulip. *Homeria collina* **(Thunb.) Vent. (Fig. 23, B and C)**

Botanical description: Habit—Single stem, shorter than leaf; corm globose, ¾ to 1in. in diameter, covered by thick, dark brown, latticed sheaths. **Leaf**—Single, ribbed, linear, 1 to 2ft. long, ¼ to ½in. wide, produced from the corm. **Flowers**—In 2 to 4 clusters, enclosed in spathes; 1½ to 2in. in diameter; tepals 6, orange-scarlet to salmon-pink with basal parts yellow. **Fruit**—Capsule, narrow, cylindric, more than 1in. long. (South Africa.)

Habitat: Pastures. Occasionally cultivated in New Zealand.

Distribution: Hamilton Bay, French Pass.

General: Cape tulip is well known as a poison plant in Australia and South Africa, and in New Zealand stock have been noticed to scour freely when allowed access to the plant, several deaths possibly caused by cape tulip having occurred. Overseas poisonings are known among sheep, cattle, horses, and man. The whole of the plant is poisonous and the plants are not made innocuous by drying. Feeding trials in Australia and South Africa have shown conclusively the toxic nature of the plant. Cape tulip, which has become a serious weed in one locality, shows effectively that plants which escape from old gardens can become a serious menace to farmers.

Symptoms of poisoning are described as partly those of an acute gastro-intestinal irritant and partly those of a cerebral depressant or narcotic. Colic, scouring, weakness, dullness, and depression are caused. Death may be fairly rapid or the animals may linger for some days before death.

Poisonous principle: Not known.

Gramineae

Broomcorn Millet. *Panicum miliaceum* **L. (Fig. 23, A)**

Botanical description: Habit—Culms stout and erect or decumbent at bases, 8in. to 3ft. tall. **Leaves**—Blades more or less pilose on both surfaces, as much as 12in. long and ½in. wide, rounded at bases. **Flowers**—In panicles more or less overlapped by a sheath 4 to 12in. long, usually nodding, rather compact, the numerous branches ascending. Seed 1/5in. long. (Warm regions.)

Habitat: Cultivated plant.

Distribution: Generally cultivated, but occasionally escapes in some localities, including Feilding and Westport.

General: An outbreak of poisoning occurred in Gisborne during the autumn of 1946 among lambs grazed on broomcorn millet which had been grown instead of the useful fodder plant Japanese millet (*Echinochloa crusgalli* var. *frumentacea* (Roxb.) Wight). The lambs were turned into the broomcorn millet when it was 8 to

12in. tall and after 5 days on the crop were seen to have developed symptoms of poisoning, 100 eventually dying. This loss represented 20 per cent. of the grazing lambs. In experiments it was shown that 2 days' grazing on broomcorn millet produces symptoms of poisoning. The plant was also shown to be toxic up to the seeding stage and to retain its toxicity even when dried. This appears to be the only recorded instance of broomcorn millet poisoning in New Zealand. Care should be taken to avoid confusion between broomcorn millet and other useful fodder millets.

Symptoms of poisoning were like those of facial eczema. The lambs were badly jaundiced, and the ears, eyelids, face, and sometimes the back were swollen and inflamed. The skin lesions occurred only on exposed parts and probably were caused by light sensitisation.

Poisonous principle: Not known.

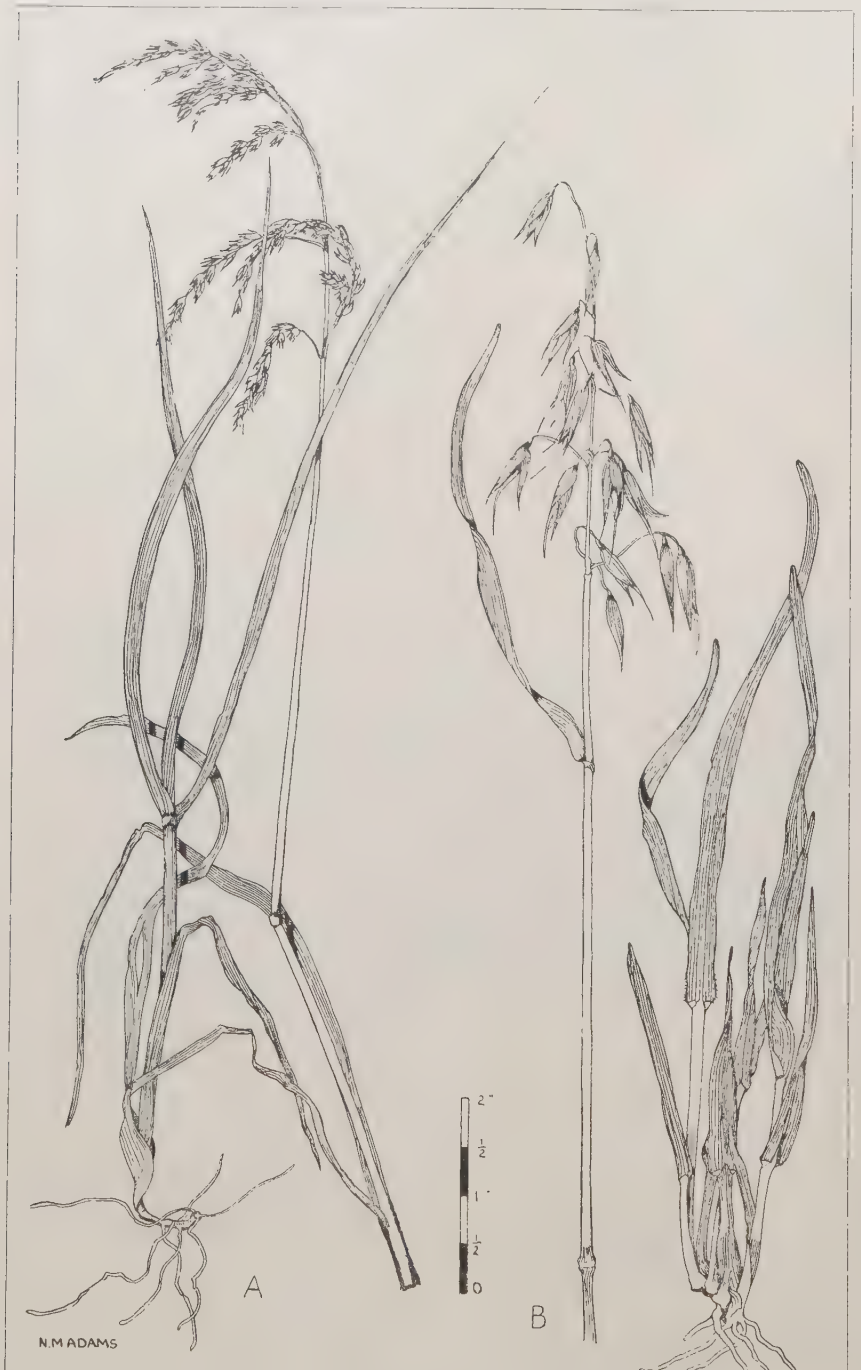


Fig. 24—A: Tall fescue (*Festuca arundinacea*). B: Oat (*Avena sativa*).

Tall Fescue. *Festuca arundinacea* **Schreb. (Fig. 24, A)**

Botanical description: Habit—Coarse, tussocky perennial with culms up to 3ft. or more tall. **Leaves**—Up to 30in. long, up to ¼in. wide, dark green, and rough margined. **Flowers**—In large panicles, more or less nodding, up to 10in. long; branches rough; spikelets up to ½in. long, more or less purple stained. (Eurasia, North Africa.)

Habitat: Damp pastures, boggy ground, and waste places.

Distribution: Common to locally abundant in both islands.

General: Symptoms of poisoning identical with those caused by ergot poisoning may be observed among cattle which are grazing on pastures carrying a lot of tall fescue. The ergots may have fallen from the seed heads by this time, and the possibility of cattle eating toxic doses from sclerotia on the ground is discounted. This condition may occur anywhere in North Island.

Symptoms of poisoning are similar to those of poisoning by ergot (*Claviceps purpurea*). Swelling of the fetlocks and lameness are symptoms in cattle, the hind feet being affected first; sensation is lost in the affected part, dry gangrene sets in, and eventually parts may be sloughed without pain; an indented line on the fetlock demarks the limit of the gangrene. The tail of a bovine is affected similarly. In sheep symptoms are inflammation and ulceration of the tip of the tongue and of the mucosa of the alimentary tract.

Poisonous principle: Not known.

Oat Hay. *Avena sativa* **L. (Fig. 24, B)**

General: One case has been reported in New Zealand of poisoning suspected of being caused by the ingestion of oat hay which had accumulated quantities of nitrates. The nitrate is reduced to the toxic nitrite in the stomach of the animal by bacterial or enzyme activity. The type of poisoning resulting resembles that caused by mangolds and variegated thistle (*Silybum marianum*). Oat-hay poisoning is frequent in the United States of America, where losses are quite serious. Losses appear to be restricted to cattle and sheep, no cases being reported of horses having been poisoned. Cows and sheep which have not eaten lethal doses may abort dead calves or lambs. There is no known method of determining good oat hay from that with toxic properties. Turkeys have been poisoned by grazing oat stubble.

Symptoms of poisoning and poisonous principle: As for mangolds (November issue) and variegated thistle (May issue).

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Flowering Plants which Can be Grown in a Cool Greenhouse

MANY New Zealand gardeners own small and efficient cool greenhouses, but few such units are used to best advantage, perhaps because the full possibilities of gardening with them are not widely realised. C. K. Ellis, Horticulturist, Department of Agriculture, Dunedin, discusses some of the very good types of plant which can be grown successfully in a greenhouse by the average amateur gardener.



A cool greenhouse of the type usually associated with home gardening in New Zealand.

THE OPINION that a greenhouse unit is beyond the financial reach of most gardeners is fairly widely held, but a suitable greenhouse for the average home gardener may be erected at little greater cost than that of a good-sized garden shed. Even in the colder parts of the Dominion a cool greenhouse extends the gardening year to a full 12 months. The range of plants which can be cultivated successfully under glass without a heating system is extremely wide and in this article only a few can be mentioned. They are divided broadly into types most useful for each season.

Spring

The cinerarias, which comprise a most important and popular group of easily grown greenhouse plants, and the calceolarias, excellent greenhouse plants showing great diversity of colour and quantity of bloom, are two families which the greenhouse owner may cultivate in spring.

Cinerarias

Sowing a little cineraria seed in boxes, pots, or seed pans at intervals throughout the period October to February ensures almost continual displays of brilliant colour from June until November. A box requires a layer of coarse, well-rotted organic matter in the bottom to assist drainage and prevent the soil from falling through the spaces between the boards. The soil level should be brought to within an inch of the top of the box and tamped down until it is of an even firmness and perfectly level. A pot or pan should be provided with adequate drainage by placing a large crock over the drainage hole, a few smaller ones above and around it, and on top of this an even layer of organic material such as spent hops or flax fibre to prevent the soil from falling among the crocks. The seed soil is firmed as filling proceeds until the level is about an inch below the rim and perfectly level. The soil should be thoroughly soaked with water before the seed is sown thinly and evenly and covered with a light topping of finely sieved soil. Glass and brown paper over the receptacle retain humidity and prevent the entry of excessively strong light. The seeds germinate rapidly, and as soon as a fair proportion have produced their cotyledons (seed leaves) the glass and paper should be removed to prevent the plants becoming drawn.

Plants should be pricked out as soon as possible after the full development of the seed-leaf stage, or at least not later than when the plant has only two true leaves. They should be 2in. apart in boxes prepared in the same way as for seed sowing, but not watered until after the plants have been pricked out so that the whole plant is moistened and the roots are assisted to settle into the soil. When the leaves of adjoining plants touch it is time for the seedlings to be potted up into 3in. or 4in. pots. Before long the small pots become filled with roots and the plants must be potted out to 6in. or 7in. pots according to their vigour.

At this stage some provision should be made for shading the plants from strong direct sunlight, and the temperature of the greenhouse should be kept as low as possible, but not below 40 degrees F. by night. Plants for early display may be obtained by maintaining the temperature at between 50 and 55 degrees. Later the plants may need to be fed with weak liquid manure. Attention to watering is most important.



[*Green and Hahn Photography Ltd. photo.*

Calceolarias in full bloom.

Calceolarias

Successive sowings of calceolaria seed may be made from November to January, but if only one batch is to be grown, December is probably the most satisfactory time. The seed soil should be rich and slightly sandy and the boxes prepared as for cinerarias. The seed must be sown evenly and should be covered only very lightly with a sandy soil mixture. A covering of glass and brown paper is necessary.



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The seedlings should be pricked out when they are very small, probably the most satisfactory time being when the second true leaf appears. They are pricked out 2in. apart in boxes, thoroughly watered, and placed in a position where the humidity is still fairly high. The seed boxes should not be discarded after the first pricking out, because the germination of calceolarias is usually very irregular.

In a few weeks the seedling calceolarias will be large enough to be potted singly into 3in. pots. The soil should be gritty, containing a fair amount of sharp sand. Potting should be fairly firm and the newly potted plants benefit from spending a few days in a closed frame. Overhead syringing on hot afternoons is useful for maintaining humidity. Ventilation should always be good, but calceolarias will not stand cold draughts. Watering should be attended to carefully and extreme fluctuations in temperature avoided.

Once the 3in. pots are filled with roots the plants should be potted on to 5in. pots, in which they remain throughout the winter. Rotted leaves should be removed regularly from the bases of the plants, which require to be watered sparingly during the colder months. They will require potting on again to 8in. pots about July, and for this potting the compost should contain a fair amount of rich, fibrous loam and be very well drained. By September the plants should be coming into bloom and may require light applications of liquid manure.

Summer

To follow the autumn-grown plants in the greenhouse the selection from which the gardener may choose includes the salpiglossis, without doubt one of the most ornamental of annuals, and the pansy-flowered schizanthus, one of the finest of greenhouse plants for brilliant displays of massed colour.

Salpiglossis

Though it grows only about 3in. high outdoors, the salpiglossis regularly attains between 4 and 6in. under glass. Flower colours range from whites and yellows to pale and dark blues and to reds and crimsons. It is a delicate plant in the early stages of growth, and for greenhouse work it is advisable to allow for failures by growing between one and a half times and twice as many seedlings as will be required.

The seed is sown during March and in the same way as for cinerarias and calceolarias. As soon as the seedlings are large enough to be handled they are pricked out 2in. apart in boxes kept in a cool part of the greenhouse. When the leaves touch, or when the plants are well rooted, they should be potted up into 3in. pots. Their growth is rapid, so before long they will need to be potted into 5in. pots. They should be kept as cool as possible and be advanced into 7in. pots for flowering as soon as they are big enough. An excellent potting mixture consists of two-thirds good fibrous loam and one-third leaf mould or well-rotted garden compost; a little bone meal is beneficial.

The plants must be kept growing strongly at all stages and the compost must not be allowed to dry out. Staking will be required later to keep the plants upright. When the first flowering buds begin to appear light applications of liquid manure will be necessary, but must be discontinued immediately flowers begin to open.



Basket begonias are excellent for autumn decoration in the greenhouse.

Schizanthus

The pansy-flowered schizanthus is probably the best known of the several types in New Zealand. Seed should be sown thinly and evenly during late February and March and covered very lightly. Seed may be germinated in a cold frame. The seedlings should be pricked out and later potted into 3in. pots in the same way as the salpiglossis, though the mixture into which they are potted should contain more organic matter—say, equal parts of loam and leaf mould. Plenty of light and air and reasonably cool temperatures are required once growth becomes vigorous again after the first potting. If growth is very vigorous, the potting into 5in. pots may be missed and the plants potted directly into 6in. or 7in. pots. A sprinkling of bone meal in the soil for the final potting is of value.

The temperature of the greenhouse should be reduced almost to that of the outside atmosphere, but the plants must be protected from cold draughts or winds. Schizanthus frequently become pot-bound, and then they must be fed with weak liquid manure often and regularly; this should be discontinued when the plants come into bloom. The most usual cause of failure with schizanthus is high temperatures.

Autumn

Autumn flowers for the greenhouse include such well-known plants as begonias, gloxinias, streptocarpus, marguerite carnations, and chrysanthemums. The culture of begonias was discussed in an article in the "Journal" for August, 1950, and the culture of chrysanthemums is widely understood. Gloxinias, streptocarpus, and marguerite carnations require treatment rather more exacting than that which the average home gardener is prepared to give.

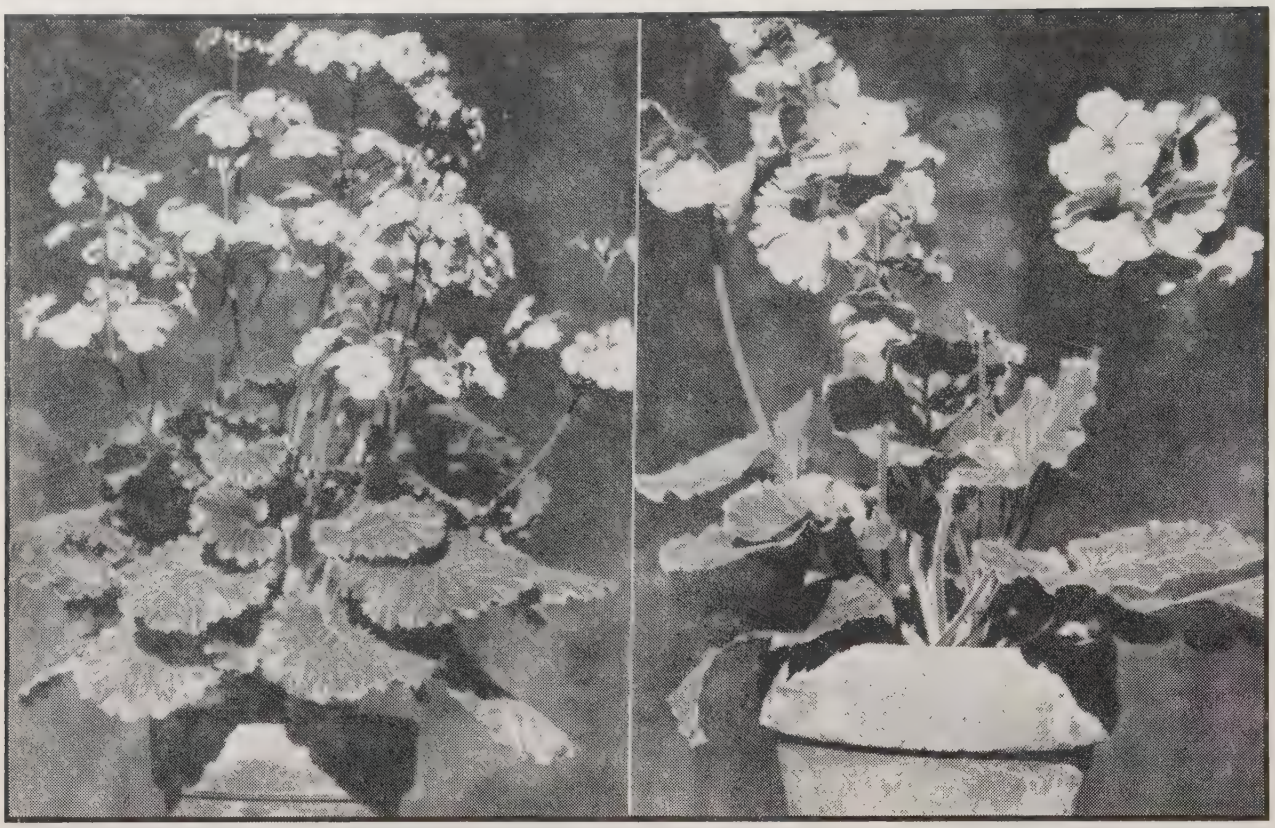
Winter

The primulas come into their own as greenhouse plants during winter. Pansies, nasturtiums, nemesias, and stock Beauty of Nice are also valuable for mid-winter flowering.

Primulas

The main types of primulas useful as greenhouse plants are *P. sinensis*, *P. stellata*, *P. malacoides*, and *P. obconica*.

P. sinensis and *P. stellata* provide a wide range of colour from coral pink, scarlets, and fiery crimsons to blues, and a few varieties have white and sometimes double flowers. Successive sowings of *P. sinensis* and *P. stellata* can be made from September to December; if a single sowing is to be made, the best time is during December. Pricking out and initial potting up should be done in the normal way, and the flowering pots in which the



[*Green and Hahn Photography Ltd. photos.*

Primula malacoides (left) and *Primula obconica* (right). Primulas are among the most popular of winter-flowering plants grown in cool greenhouses.

plants are finally placed must have free drainage. Germination is usually very irregular, and pricking out extends over a considerable period. Primulas should always be potted firmly, and the most satisfactory compost consists of equal parts of good loam and a mixture of leaf mould, well-rotted animal manure, and sharp sand. Throughout the warmer weather light shading is necessary to prevent damage from the direct rays of the sun. Primulas should always be watered liberally during summer, but water should be applied carefully as the temperature falls with the onset of autumn. Between 50 and 55 degrees F. is the most satisfactory temperature in which to flower *P. sinensis* and *P. stellata.*

Primula obconica has a longer flowering season than *P. sinensis* or *P. stellata* and the blooms grow in larger sprays in white and shades of pink, crimson, lilac, and blue. In contrast to *P. sinensis* and *P. stellata,* it is a shade-loving plant and should be spared the direct rays of the sun at all times during its growing period. Seed is sown during July in pots, pans, or boxes and is treated in the same way as that of other greenhouse plants. It should be germinated in a temperature of about 65 degrees F., if possible, and covered with glass and brown paper until the seedlings appear. After being pricked out they should be given adequate air and a little exposure to filtered sunlight. Before long the plants will be ready for potting into 3in. pots in a compost of two-thirds loam and one-third leaf mould with a liberal sprinkling of sharp sand. During midsummer the plants can be grown in an outside cold frame, and during this period they should be watered very liberally. Later they should be potted to 5in. or 6in. pots; this potting should be firm, and a little bone meal may be added to the compost. Though a lot of water may be applied, the plants should not be allowed to become sodden. Occasional applications of weak liquid manure are very beneficial from about March. A temperature of 50 to 55 degrees is the most satisfactory for flowering, and humidity should be kept reasonably high.

Primula malacoides is the daintiest of the primulas, the flowers being small and grouped in whirls or trusses around a tall flowering stem. The older types were usually all of a lilac colour, but in recent years they have been improved to provide pinks, ranging from salmon to deep rose, and pure white varieties are also obtainable. The seed may be sown from October until December, and treatment throughout the growing season should be as for *Primula obconica* except that *P. malacoides* does not require such close shading.

Nasturtiums

Nasturtiums, preferably of the Golden Gleam type, are useful for climbing up strings in the greenhouse and for trailing from hanging baskets. Seed is sown during January singly in 2in. or 3in. pots and cultivation after germination is extremely easy. They may flower in 7in. pots, the flowering period being May, June, and July.

Nemesia

For winter flowering in the greenhouse nemesia seed should be sown during January and February and gentle heat (about 55 degrees F.) maintained during the period of germination. The plants should be potted progressively through 3in. to 5in. pots after being pricked out and may be kept in a cold frame to encourage bushy growth until the greenhouse is clear for them to be placed inside.

Pansies

Pansy seed should be sown during October and November to produce flowers in the greenhouse from May until August. Pansies reach a height of 9 to 12in. under glass and are very free flowering.

Stock

Seed of the excellent stock Beauty of Nice may be sown from December until February and will produce a succession of blooms from June until August. Culture is easy, plenty of fresh air and adequate water being the main requirements. Stocks may be grown under glass in 5in. pots and should be potted very firmly. Light applications of weak liquid manure should be given during the period immediately before flowering.

Annuals of the hardier types can be sown in open beds in September if the soil is not too wet. The top few inches of soil should be cultivated, all lumps broken down, the soil trodden fairly firm, and the surface raked until it is uniform. Seed is far better sown too thinly than too thickly. An ¼in.-mesh sieve can be used to spread a light covering of soil over the seeds—not more than four times as thick as the diameter of the seeds. For satisfactory results the seed-bed must be firm. Among the many annuals that can be treated thus are alyssum, marigolds, candytuft, cornflowers, clarkias, godetias, cosmos, larkspur, and night-scented stocks. Other annuals which are less hardy can be raised in the manner described in an article in the "Journal" for July, 1950. Seeds that should be sown during September for raising in this way are African marigolds, schizanthus, zinnias, charieis, *Perilla nankinensis*, capsicum, dimorphotheca, and ursinia.

Bedding plants raised from earlier sowings of seed can be planted out in September in most districts, though where late frosts are likely such tender types as salvias and zinnias should not be planted out until the following month. Bushy plants with plenty of strong, green foliage are best for bedding, and flowers or buds present should be cut off to encourage branching and better flowering at the required time. Plants that have been in boxes too long tend to become long and spindly and have yellowed foliage as a result of partial starvation; such plants are never satisfactory.

Bulbs which have flowered early in the season may still carry a mass of foliage which is perhaps a little untidy, but the gardener should not yield to the temptation to cut it off. To do so is to deprive the bulbs of the food which is necessary to complete development and can result only in smaller bulbs and poorer flowering next season. In herbaceous borders bulb foliage can be made tidy by tying the leaves into neat bunches.

Chrysanthemums can now be lifted and divided and root pieces replanted. Cuttings may be taken and set in sand in a cold frame to root. A cutting should be 3 to 4in. long, have the lower leaves removed to reduce transpiration, and be cut cleanly at the base immediately below a node or point of origin of a leaf. Cuttings should be kept moist all the time and be shaded from bright sunlight. After about 3 weeks the buds at the tips begin to produce new green leaves, indicating that root formation is well advanced. The shading should then be removed and the lid of the frame opened or taken off. Shortly after that the plants may be potted up or planted into the borders.

Dahlias which were boxed for starting in August should be producing shoots around the necks of the tubers in the following month. When these shoots are growing well the plants may be increased by either of two ways: The clumps of tubers can be divided carefully by pulling them apart, care being taken to ensure that a healthy shoot is attached to each piece of tuber; or plants can be propagated readily from cuttings. A shoot for a cutting should be cut off immediately below a pair of leaves about 3in. from the tip, the lower leaves removed, and the cuttings inserted 1in. deep in finely sieved river sand in boxes and as close together as they will fit without being crushed. The boxes should be placed in a greenhouse or cold frame for the cuttings to root. In most districts the cuttings can safely be planted directly into the borders as soon as they have rooted well.



[*Green and Hahn Photography Ltd. photo.*
Most herbaceous perennials can still be lifted and divided by the method shown in the illustration.

Gladioli are usually planted in numbers in most districts in September. When the corms are removed from store they should be examined thoroughly, and this can be done satisfactorily only by removing the husks. Any patches of rot should be cut away cleanly with a sharp knife. Badly infected corms should be burnt. Flowers of sulphur should be scattered over all cut surfaces before planting is begun. In heavy soil the corms should not be planted more than 3in. deep and in light friable soil not more than 6in. deep. The recommended distance between corms is 8in.



When gladiolus corms are taken from storage before being planted, the husks should be removed as they have been from those illustrated so that rotted patches can be detected and removed with a sharp knife.

Herbaceous perennials often throw up great numbers of shoots at this time of year, and if all these are allowed to grow, only a mediocre show of flowers can be expected. The shoots should be thinned out until only a few remain. All planting of new perennials should be completed in September.

Hydrangeas should be pruned now in cold districts or where the work was not done during autumn. All last season's flowering stems should be cut out and all new shoots left uncut, as the new flower buds are borne at the tips of these. Two handfuls of blood and bone scattered about the roots of each bush in September should prove beneficial. It should be forked in very lightly with a hand fork.

Lawns should be given their spring dressing of fertiliser during September. The best dressing is a mixture consisting of 3 parts by weight of sulphate of ammonia, 1 part of superphosphate, and 1 part of sulphate of iron, applied at the rate of 1oz. per square yard.

Pot plants indoors or in a greenhouse should receive attention now. A plant in need of new soil can be removed from the pot, the crocking material taken away from the base, as much soil as possible scraped away without damaging the roots too greatly, and the plant repotted into a pot of the same size or only very slightly larger. If the need for repotting is not urgent the top inch or two of soil can be scratched away and emptied out and fresh potting soil substituted.

Rose pruning should now have been completed in all districts, and the beds should be given a topdressing of well-rotted manure, compost, or leaf mould to help retain moisture during summer.

Wools for Hand Knitting and Crochet

FIRST recorded mention of hand knitting in Britain was in 1530, during the reign of Henry VIII, though undoubtedly it is much older than that, the word "knitting" being derived from the Saxon "Cnyttan". The knitting of stockings, previously made of cloth, became common in Queen Elizabeth's time. The first knitting machine for making hosiery was also invented during her reign and made its initial appearance in 1589, and since then the twin pastimes of knitting and crochet have grown steadily in popularity.



THE general level of skill has risen enormously in recent years. Pattern designers bring out ever more ambitious designs, and women who were once content with straightforward scarves, or at best a simple ribbed jumper, are now achieving fashionable knitted dresses with a professional touch. During the war the women of Britain, the Dominions, and allied countries sent a flow of socks, pullovers, scarves, and other hand-knitted comforts to the fighting services.

Hand-knitted garments have special qualities of their own. They are soft, naturally elastic, crease resisting, warm, durable, and easy to wash. Crochet, which is worked with a crochet hook (the word derives from the French "croche", meaning a hook), gives a fabric which is soft and full, though slightly more bulky and less pliable. Through knitting or crochet (and each has its special uses) more and more women are discovering that to "make it yourself" is not only a pleasant and satisfying pastime but practical and worth while.

Choosing the Right Wool

"The right wool for the purpose" is a cardinal principle of choosing knitting wool. The bunched-up skeins on the shelves of a wool shop may look deceptively alike, apart from their gradations of colour, but innumerable differences in knitting wools suit them to a wide variety of purposes—differences of yarn, thickness of thread, degree of twist, and number of ply. In fact, most patterns specify the exact type of wool to be used.

In general, the soft, loosely spun yarns provide most warmth, because of their greater air content, and harder twist yarns are most suitable for clothes that face hard wear, such as children's garments, socks, stockings, men's cardigans, and pullovers. For baby clothes, or anything that has to be washed a lot, unshrinkable wool or wool that has been given a high degree of shrink resistance is an obvious choice.



Wool has numerous imitations, many of which are claimed to be "just like wool" or "as good as wool", but, however good an imitation, it cannot have all the natural virtues of health, comfort, and protection which are unique to pure wool.

Sizes of Wool and Needles

The word "ply" derives from a Latin word meaning "fold", and ply in knitting wool refers to the number of individual threads folded or twisted together to make a thickness of yarn. Wools of equal ply are not necessarily of equal thickness, for that depends on the thickness of the threads and on whether they are twisted together tightly or loosely. For example, a 2-ply wheeling, a 2-ply crochet wool, and a 2-ply fingering are all made of 2 thicknesses twisted together, yet each is of different thickness.

The thickness of the knitting needle depends on the thickness of the wool and the type of garment to be knitted, and correct choice is important. Knitting needles are usually numbered from 1 to 16, and the lower the number the thicker the needle. The thinner the needle, the shorter the loop and the greater the number of rows, so that firmness and elasticity are increased. Thicker needles make fabrics of looser texture and less elasticity.

Types of Wool

Experienced knitters know the value of understanding the respective merits of the wools available, and following are some notes on the more familiar types:—

Fingering wools: Fingering is the basic knitting yarn and is used for practically every purpose. It is a smooth, even worsted, usually of medium twist and thickness, though there are many varieties. Most of it is 3-ply or 4-ply, though 2-ply fingerings are often made for lighter garments and 5-ply is sometimes available. Fingering wools are soft enough to be used for baby garments, yet give the wear required for children's clothes.

Knitting and double knitting: Knitting wool is very similar to the fingerings, though usually of firmer twist, and is made only in 3-ply and 4-ply. Double knitting is another worsted, made only in 4-ply and about double the thickness of 4-ply knitting or fingering. It is particularly suitable for sports garments, scarves, brushed rugs, heavy socks, and stockings.

Wheelings are spun on the woollen principle, usually in 3-ply. Three-ply wheeling is more than double the thickness of a 3-ply fingering or knitting, being roughly equal in weight to worsted double knitting and used for much the same purposes.

Crochet wool is a 2-ply worsted with a very firm or "pearly" twist and, in spite of its name, is just as suitable for knitting. It is about twice the thickness of a 2-ply fingering, so knitting instructions for the two are not interchangeable. Very firm 2-ply yarns are used for jumpers, gloves, vests, and baby garments, and the thicker, fleecy types of yarns are ideal for pram covers and cot blankets.

Botany: This term covers all fine-quality wools, very soft to handle, obtained from the Merino sheep. Botany wools are ideal for fine underwear and baby garments, and for crochet bed jackets.

Crossbreds: This expression refers to a class of knitting wool not quite as soft to the touch as Botany, but with qualities that make it suitable for garments which have to resist very hard wear, such as socks and stockings, and clothes for growing children.



WITH the aim of luring the New Zealand housewife into venturing outside the realms of the orthodox dietary, the first section of an article by Dorothy Johnson, Rural Sociologist, Department of Agriculture, Christchurch, in last month's "Journal" described the attractions of Chinese cookery and the methods and ingredients used. This, the concluding section, deals more specifically with recipes, starting with those for rice and noodles, which are used to give body to many Chinese dishes. The subject is covered only in a very general way. The recipes do not deal with, for instance, the cooking of poultry, of which Chinese people are very fond, but with the exception of chicken and duck dishes associated with particular districts (such as Pekin duck) the methods of serving poultry are similar to those of serving other meats.

CORRECT consistency is important in the cooking of rice, which should be neither undercooked nor wet and mushy. The proportions are 1 cup of rice and 2 to 2½ cups of water. The rice is cooked slowly until all the liquid is just absorbed, thus avoiding the necessity to strain the rice and reject the water and much of the food value. This can be achieved either by steaming the rice in a double saucepan (or a basin in a saucepan) or by cooking it over direct heat and pushing the pan to a cooler part of the stove in the later stages when there is a real risk of burning. Here are other recipes:—

Plain Rice, Boiled or Steamed

Wash ½lb. of rice three or four times until the water is clear. As even heat is required, use a very thick saucepan. Add water to an inch above the rice, cover it, and boil it over moderate heat until the water is nearly absorbed. Turn the heat low, cover the saucepan tightly, and cook the rice for another 20 minutes without stirring it. Care is necessary to prevent burning, which can be avoided by turning the rice into a steamer for the last 20 to 30 minutes. Make small holes in the pile of rice with a fork or skewer (the Chinese would use a chopstick) to help the steaming process.

Stewed Rice

1 cup of rice
2 to 2½ cups of stock
1 or 2 mushrooms, chopped
Salt to taste

Stew all the ingredients together gently until the rice is cooked, adding a little more stock if the rice seems to be drying up. Rice cooked in this way is very good with fish dishes.

Fried Rice

As Europeans fry cold potatoes, so the Chinese fry steamed rice. They add other ingredients, turning it into a very savoury dish with flavours varying according to the extra ingredients added. This method could easily be adapted by country housewives in New Zealand to vary the fried potatoes which form so regular a part of farmhouse menus.

To every cup of cooked rice allow 1 egg. Melt 1 tablespoon of lard, add salt, stir in the rice, and fry the mixture for about 5 minutes, stirring all the time. During the frying add any chopped-up scraps of meat, fish, poultry, or vegetables that are available to give extra flavour to the dish. Beat the egg and add it to the mixture, stirring until the egg is lightly set. Add 1 tablespoon of soy bean sauce and 2 or 3 chopped spring onions. Stir the mixture well and serve it very hot.

If cubed cold potatoes are substituted for the rice, they can be made a much more interesting dish. As a variation 1 teaspoon of curry powder may be added to the fat before the potatoes are put in.

Noodles

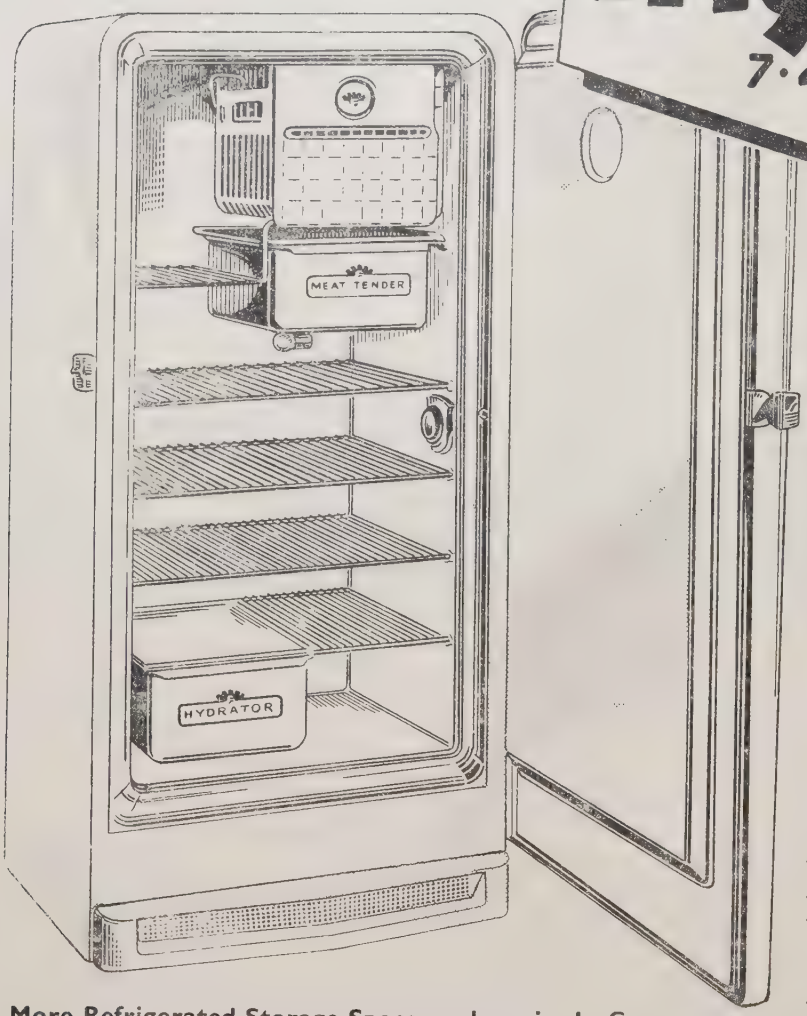
Like rice, noodles are served either boiled in stews and soups or fried crisp and piled over braised or stewed meat, fish, and vegetables. They may be prepared at home as follows:—

Slightly beat an egg yolk and with it mix 4oz. of flour and a pinch of salt into a very stiff paste, using a little water if necessary. Knead the paste thoroughly until it is no longer sticky and leave it in a cool place for ½ hour. Then roll it out very thinly. To avoid uneven rising of the dough always roll it forward. Frequent applications of flour will be needed during the process. Equal quantities of ground rice and ordinary flour are best. Pleat the rolled pastry into 2in. folds and cut it crisply into very fine slices for noodle soup, or slices about 1/10in. thick for braising or frying. Sprinkle a little flour over the strips and loosen them on a large plate. They will then be in the form of long strips. Cover them with a slightly damp cloth if they are not to be used immediately. Boil them in plenty of water. Put the noodles loosely in the boiling water, separate them with chopsticks or a fork if they stick together, and cook them for about 5 minutes.

Fried Noodles

1lb. of cooked noodles
¼lb. of vegetables
¼lb. of lean pork
1 tablespoon of soy bean sauce
4 tablespoons of lard

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Cabbage, onions, celery or bean sprouts, and mushrooms if obtainable are a good mixture for the vegetables; cut them into thin strips. Cut the meat into strips. Fry the meat and vegetables in 1oz. of hot lard for 5 minutes. Add 1 tablespoon of soy bean sauce and mix the ingredients well. Fry the cooked noodles separately in 2 tablespoons of lard, combine them with the mixture, and cook the whole for another 5 minutes. Serve it very hot.

Fried noodles, like fried rice, is a mixed dish suitable for a complete meal. The proportions of meat and vegetables can be varied to taste or according to the contents of the larder, and the same applies to the kinds of meat and vegetables. Veal, chicken, ham, beef, or mutton can be substituted for the pork.

Meat and Vegetable Dishes

The following recipes for meat and vegetable dishes have been chosen to show the varieties of combinations of ingredients and the variations of method used by individual cooks.

Beef with Cauliflower

- 1lb. of steak
- 2 tablespoons of lard
- 1 medium-sized cauliflower
- 2 tablespoons of soy bean sauce
- 1 teaspoon of salt
- 2 teaspoons of root ginger
- 2 teaspoons of cornflour
- 1 teaspoon of sugar
- ½ cup of water or stock

Cut the steak into thin slices about 2in. by ¾in. Chop the ginger finely. Wash the cauliflower and separate it into small sprigs; the tender stalk and leaves can be cut into slices and used in this or another dish. In a preheated heavy pan heat the lard and salt; add the ginger to them. Add the sliced meat and cook all rapidly for 5 minutes while constantly turning it over. Add half the soy bean sauce (or meat or yeast extract), stirring the mixture all the time. Add the cauliflower, turning it rapidly for a few minutes to bring all of it into contact with the hot fat. Add the stock, cover the pan tightly, and cook all over moderate heat for about 8 minutes. Blend together and add the cornflour, the rest of the soy sauce, the sugar, and a little water. Cook the mixture for a few more minutes, stirring it constantly until the sauce thickens. Serve the dish immediately with hot rice.

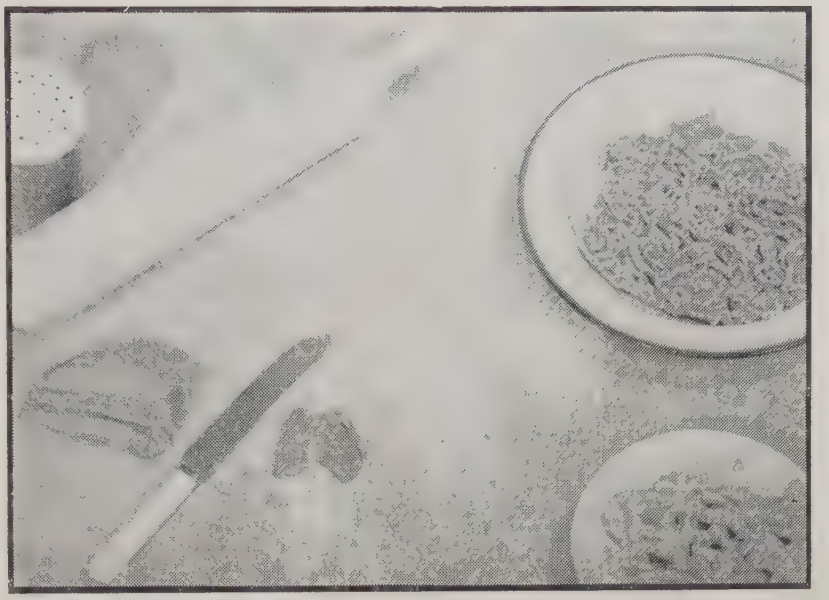
The ingredients of this dish can also be varied. Other suggestions for vegetable combinations are: A clove of garlic, a tomato, and 1lb. of small new potatoes instead of the cauliflower; sliced celery and leeks; or sliced cabbage or brussels sprouts.

To make a luxury dish prepare a cup of oyster sauce by heating a dozen finely chopped oysters in a cup of oyster liquor and add this in place of the stock.

Sweet and Sour Pork

- 1lb. of pork
- 2 tablespoons of cornflour
- ¼ cup of stock or water
- 1 dessertspoon of sugar
- 1lb. of lard or oil
- ½ cup of vinegar
- ½lb. of pickles
- 1 tablespoon of soy bean sauce
- ½ teaspoon of salt

Cut the pork into slices 2in. by 3in. Ribs of pork can be used for this dish, chopped into 2in. lengths. Make a mixture of the cornflour, water or stock, and salt. Drop the pork into it and mix it well. Fry the pieces in a saucepan of boiling lard until they are brown. Drain them well. In another pan put the vinegar, soy bean sauce, and sugar and stir them well over low heat. Then add all the fried pork pieces and the pickles cut up small. Stir these together quickly for 2 or 3 minutes and serve them with a dish of mixed vegetables and rice.



The preparation of noodles. At the left is the pleated dough and two cut slices, at top right a dish of uncooked noodles, and below it a dish of cooked noodles.

Minced Pork or Beef Balls

- 1lb. of meat (half fat)
- 1 egg
- 2oz. of breadcrumbs
- 1 teaspoon of cooking sherry
- 1 to 2 tablespoons of soy bean sauce
- 1lb. of spinach or cabbage
- 1 teaspoon of root ginger
- ½ teaspoon of salt
- Flour to mix
- 1 tablespoon of lard
- 1 tablespoon of fat

Mince the meat finely and mix it well with the breadcrumbs, egg, and sherry, adding flour if the mixture is too wet. Roll it into balls the size of large marbles. Heat the lard with the salt and ginger. Fry the balls lightly. Add the soy bean sauce and ¼ cup of water. Cook the balls slowly for ½ hour, turning them during the process. Serve the balls when they are brown and soft. Fry the chopped-up spinach or cabbage separately in the fat, add it to the meat balls, and simmer them again for a few minutes. Serve them with rice.

This dish can be varied by serving it with cucumber, asparagus, silver beet, or french beans. Each vegetable is cut into slices, fried, and added to the meat.

Veal and Celery

- ½lb. of veal steak
- ½lb. of celery
- 2 or 3 spring onions
- ¼lb. of mushrooms
- 1 tablespoon of soy bean sauce
- 1 clove of garlic
- 1 teaspoon of cornflour
- 1 tablespoon of lard
- 1 teaspoon of cooking sherry

Cut the meat and vegetables into fine strips. Mix the meat with the cornflour made into a thin paste with a little water. Fry the vegetables in hot lard for 5 minutes. Put in the meat and fry it quickly for another 5 minutes. Add the soy bean sauce, garlic (finely chopped), and sherry and cook the mixture for another 5 minutes, stirring constantly.

Liver and Onions

- 1lb. of liver
- 4oz. of onions
- 1 teaspoon of ginger or garlic
- 1 teaspoon of lard
- 1 dessertspoon of cornflour
- 1 dessertspoon of soy bean sauce
- A few spring onions

Cut the liver into small slices and mix it with the cornflour, moistened with water or sherry, and the ginger or garlic. Fry it quickly in the lard and add the onions. Keep stirring the mixture and pour in the soy bean sauce with the spring onions cut into inch lengths. The dish should be cooked in about 7 minutes and the mixture thickened with cornflour paste before being served.

Fish and Egg Dishes

Fish Rolls Fried in Batter

- ½lb. of thin fillets of fish
- ¼lb. of mushrooms
- ¼lb. of cauliflower sprigs
- 2oz. of pork
- 2 eggs
- 1 tablespoon of soy bean sauce
- Flour
- Salt
- Deep oil or lard for frying

Soak the fillets in the soy bean sauce while the filling is being prepared. Chop the vegetables and pork finely. Beat 1 egg slightly. Heat a small quantity of lard in a pan, pour in the egg, and cook it carefully until it is just firm. Chop it into strips. With a little more fat fry the vegetables and pork. Add a little soy bean sauce and salt to taste and combine the mixture with the chopped-up egg. Roll up some of this mixture in each fillet and fasten it with a skewer.

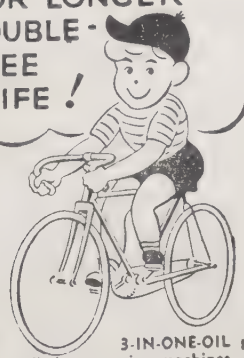
Make a thin batter with the other egg and sufficient flour and salt. Dip the fish rolls into it and fry them crisply in smoking-hot deep fat. Serve them with steamed rice.

Fish Rolls with Brussels Sprouts

- Fish rolls
- 1lb. of brussels sprouts or other green vegetable
- 2oz. of lard or butter
- 1 tablespoon of soy bean sauce
- ½ cup of stock

Prepare the fish rolls as in the previous recipe, but do not dip them in the batter or cook them.

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Shred the vegetables or cut the sprouts in halves and fry them in butter for 5 minutes, stirring constantly. Add the fish rolls, soy bean sauce, stock, and seasoning and simmer all with the lid on for 10 to 15 minutes. Serve them with rice.

Egg Soup

1 tablespoon of chopped onions
½oz. of lard or butter
1 dessertspoon of soy bean sauce
2 eggs
Pinch of ve tsin
1½ pints of seasoned stock

Fry the onions in fat, add all the ingredients except the eggs, and bring them to the boil. Remove the pan from the heat and pour the beaten eggs into it in a thin stream which sets in a ribbon as it falls in the soup.

Eggs Canton Style

1 cup of bamboo shoots or cauliflower sprigs
½ cup of scallions (small onions)
1 cup of celery
6 eggs
1 teaspoon of salt
A dash of pepper
1 tablespoon of lard

Finely shred the bamboo and celery into a bowl. Add the diced onions. Break in the eggs, add the seasoning, and beat all lightly. Heat the lard in a 10in. pan and cook the egg mixture over a low heat until the top is firm (about 5 minutes). Cut it into four, turn each quarter over, and cook them for another 3 minutes. Serve them with hot rice.

Chicken or Vegetable Omelet

2 cups of cooked chicken
1 cup of onions
½ cup of bamboo shoots
3 tablespoons of lard
2 teaspoons of salt
6 eggs
1 tablespoon of cornflour
2 teaspoons of soy bean sauce
¾ cup of soup or stock
1 quart of fat

Dice the chicken and slice the vegetables. Heat the lard in a 10in. pan and cook the vegetables over moderate heat for 5 minutes, stirring all the time. Beat the eggs and seasoning lightly and add the vegetables to them. In a heavy saucepan heat a quart of fat (it should be about 2in. deep) to a moderate heat (300 degrees F.). Drop the egg mixture into the fat in spoonfuls. Cook them for 5 minutes, turning them, if necessary, to brown them. Drain them on paper. Make a sauce with the cornflour, soy bean sauce, and stock and serve it with the omelet.

For a vegetable omelet any mixture of vegetables including tomato can be substituted for the chicken. Fish is delicious served this way by substituting it for the chicken.

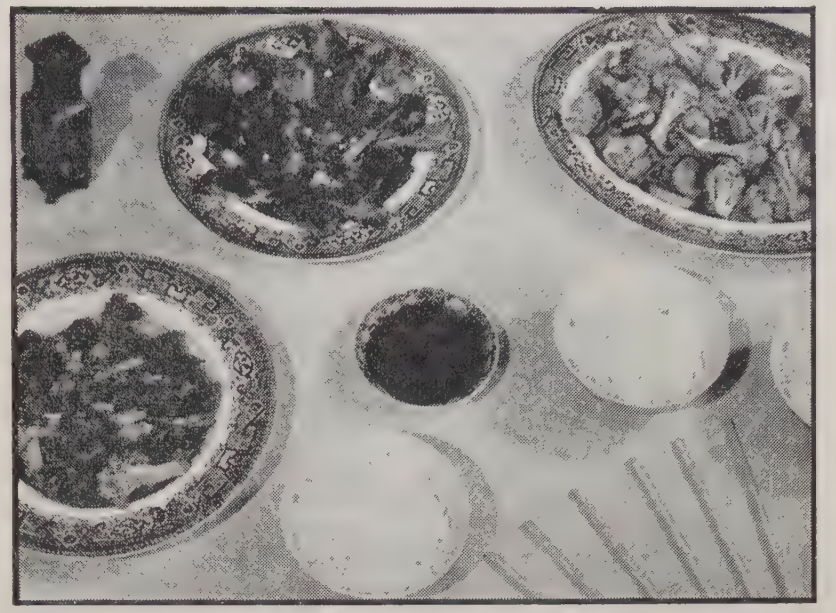
Scrambled Egg

Add seasoning and a tablespoon of water for each egg used. Beat the mixture lightly and drop it in spoonfuls into hot deep fat for a minute or two.

Chinese Fish Balls

1lb. of filleted fish
1 tablespoon of cornflour
1 dessertspoon of lard
1 tablespoon of vinegar
3 slices of ginger
1oz. of dried mushrooms
A few spring onions
1 egg
1 teaspoon of salt
A little pepper

Chop the fish and vegetables, add the seasoning, and mix them with the egg, fat, vinegar, and enough cornflour to bind all together. Roll the mixture into little balls, which can be cooked either in boiling soup for 5 minutes, or in deep fat and served with a sweet sour sauce made as in the recipe for sweet and sour pork.



Three Chinese dishes, veal and celery, sweet and sour pork, and meat balls and cauliflower, with soy bean sauce and rice.

Meat-fish balls are delicious. Use half fat pork and half fish chopped together. Bind them together with white of egg and steam the balls for 5 to 10 minutes.

The fish bones can be boiled to make soup.

Crayfish or Shrimps with Vegetables

3 tablespoons of lard
1 teaspoon of salt
1lb. of shrimps or crayfish
1 cup of bamboo shoots or celery
1 cup of cabbage or brussels sprouts
1 clove of garlic
1 cup of stock
2 tablespoons of cornflour
2 teaspoons of soy bean sauce
1 tablespoon of small onions

Heat the lard in a heavy 10in. pan. Add the seasoning and crushed garlic. Cook these for a few moments and remove the garlic. Add the chopped fish and cook all over moderate heat for about 2 minutes, stirring constantly. Dice the vegetables and add them with the stock. Cover the pan tightly and cook the mixture for 8 minutes over moderate heat. Blend the cornflour and soy bean sauce with ¼ cup of water and add this paste to the pan, stirring constantly until the sauce thickens. Finally dice and add the onions. Serve the dish immediately with hot rice.

Chinese Stuffed Fish

If fish is ordered in a Chinese restaurant in the north, it is brought to the customer kicking on the end of a string to prove that the fish to be eaten is fresh. Many a visitor has been astonished on being served with a baked whole fish which proves to have not a bone inside. This is how it is done:—

A 3lb. fish
1 tablespoon of peanuts
2 tablespoons of walnuts
2 tablespoons of celery or bamboo shoots
1 teaspoon of salt
2 tablespoons of small onions
1 teaspoon of root ginger
7 tablespoons of oil or lard
2 tablespoons of soy bean sauce

Cut the head off the fish without breaking through the skin on one side. Remove the skin from the fish in one piece. Fillet the fish and mince the flesh and the nuts and vegetables. Mix all thoroughly together with 3 tablespoons of melted lard or oil, the soy bean sauce, and the salt. Stuff the mixture into the skin of the fish. In a shallow baking dish place 4 tablespoons of lard, add the fish, and bake it at 425 degrees F. for about 45 minutes, tasting it occasionally. Serve it with hot rice.

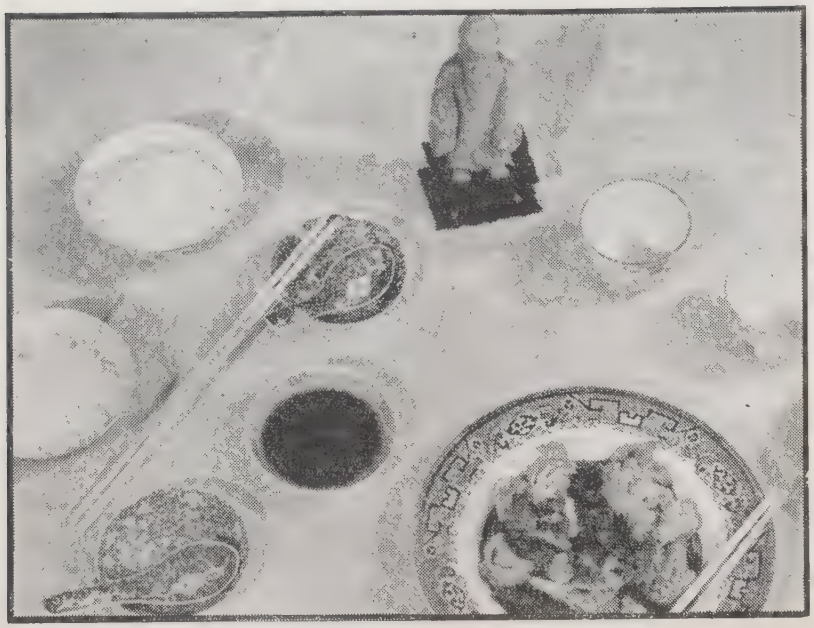
Steamed Lobster or Crayfish

1 lobster or crayfish
2 tablespoons of lard
2 tablespoons of sherry
2 tablespoons of soy bean sauce
1 teaspoon of sugar
1 teaspoon of salt
1 teaspoon of chopped ginger root
A dash of pepper
4 tablespoons of small onions

Cut the fish into two lengthwise, then across in 2in. pieces with the shell on. Cut each claw and leg into three sections. Place all in a shallow dish. Blend the lard, sherry, sauce, sugar, salt, and ginger together and pour them over the fish. Cover the dish tightly and steam it over water for 30 minutes. Sprinkle the fish mixture with the chopped onions, and steam it for another 3 or 4 minutes. Serve it with hot rice.

Other Methods of Cooking

Roasting, steaming, braising, and stewing recipes are not given. The methods are almost the same in Chinese as in Western cookery, but the meat is usually minced or cut in strips, even for roasting. However, all have the variations of Chinese vegetables and flavouring substances; for example, the soy bean sauce, ginger root, dried tangerine or orange peel, water chestnuts, bamboo shoots, and bokchoy hearts (brussels sprouts). Bones of the meat, poultry, or fish are boiled to make stock or broth as a basis for soup or to add to the stewed or braised dishes.



A dinner for two with tea bowls and china spoons for the soy bean sauce.

In a steamed-meat dish each pound of minced meat is mixed thoroughly with a teaspoon of salt, a dash of pepper, and a tablespoon each of soy bean sauce, oil or melted lard, and cornflour. It is placed in a shallow dish or casserole and an inch square of dried orange peel is shredded and sprinkled on top, followed by half a cup of flavouring vegetable and one or two whole eggs. The dish is placed in a steamer, the pan covered tightly, and the food cooked over a low flame for about an hour.

These mixed dishes of meat and vegetables are usual in everyday meals. One of their advantages is that a small amount of meat can be shared by the whole family. Another is that in mixed dishes the meat and vegetables lend each other flavour and are more savoury than if they are cooked separately, then served on the same plate, as is the Western custom.

Most of the recipes that have been given could be adapted to make dishes with left-over meats or vegetables. Any one of them would result in a tasty dish if diced cold meat were used instead of fresh meat; in fact, raw and cold cooked meat can be used together.

Chinese Patties

1lb. of meat
½lb. of vegetables
1 tablespoon of soy bean sauce
2 tablespoons of lard
1 to 2 tablespoons of sherry
¾lb. of flour
1 egg
Pinch of salt

Mince the meat and vegetables and fry them in lard for 5 to 10 minutes with the soy bean sauce and sherry. Leave them to get cold. Make the pastry with the flour, egg, and salt, adding 1 cup of water gradually. Roll it out (always forward) thinly and cut it into 3in. rounds. Fill the rounds with the mixture and close the ends. The patties may be cooked in one of three ways:—

1. Fry them in deep fat until they are crisp and brown. Serve them with soy bean sauce.

2. Semi-frying does not take so much fat. Fry the patties in 1oz. of lard or oil until the bottom of each is brown. Pour ½ cup of stock or water over them and cook them with the cover on for 3 minutes. When the steam has penetrated the top part of the patties and the water in the pan has evaporated they will be ready for serving.

3. Drop the patties into a large pan of boiling water and cook them until they float to the surface. Then pour on a few drops of cold water to prevent their sticking to each other. Serve them with vinegar or soy bean sauce.

Spring Rolls

½lb. of minced pork, beef, or veal
A slice of fresh ginger root or a clove of garlic
1lb. of lard or oil
½lb. of bean sprouts, onions, and celery
1 dessertspoon of soy bean sauce
½lb. of flour
Salt and pepper

Cut the vegetables into fine strips. Fry them in a small amount of lard for 3 minutes. Add the minced meat and soy bean sauce and fry all together quickly for another 5 minutes, stirring constantly. Cool the mixture for at least ½ hour.

Make a mixture of batter consistency with the flour and about ¾ pint of water. Heat a heavy 6in. frying pan over low heat and grease its surface evenly with oil. Pour a tablespoon of the flour mixture into the pan, letting it run evenly over the whole pan until it is dry. Then turn it out on to a flat plate. Repeat the process about 18 times. This is so-called cooked pastry. An egg can be used in the pastry.

Fill each round with an oblong of cooked meat and vegetables, fold up first both ends and then the sides, and close the edges with a little water. Fry the rolls in the lard or oil three or four at a time until they are brown.

Braised Marrow

1lb. of marrow
1 tablespoon of soy bean sauce
1 dessertspoon of cornflour
1 to 2oz. of lard
1 cup of stock or water
A few spring onions

Cut the marrow into 2in. squares. Fry them until they are golden brown, then pour in the soy bean sauce and salt and shake the mixture for several minutes. Add the cornflour mixed with the stock, and simmer the mixture for another 5 to 10 minutes. Serve it with chopped spring onions.

Radishes when a little too big to be eaten raw are delicious served this way. If a few scraps of diced cold meat are cooked with them or with the marrow, a quickly made and appetising lunch or supper dish can be served.

Green Peas, Broad Beans, and French Beans

To 1lb. of any of these vegetables allow 1oz. of lard and about a teaspoon of salt. Fry the vegetables in the hot fat lightly until they are completely covered with fat. Season the mixture with salt. Add a few tablespoons of water one at a time until the vegetables are cooked. The time required varies from 7 to 15 minutes, according to the age of the vegetable.

This method preserves the intensity of the green and food value is not wasted. Vegetables like carrots and turnips can be sliced and cooked in the same way, but more water should be added after the initial frying.

Meat with Potatoes

½lb. of diced meat
1lb. of cubed potatoes
1 to 2 teaspoons of curry powder
A few spring onions
1 dessertspoon of soy bean sauce
1 to 2 tablespoons of lard

Fry the meat and potatoes in the lard until they are brown, adding the soy bean sauce and the curry powder and stirring all the time. Add about a cup of water and cook the dish with the lid on until the potatoes are soft and have absorbed the liquid. It does not need thickening with cornflour.

Eggs and Peas

1lb. of shelled peas
6 eggs
¼lb. of diced meat
2 teaspoons of sugar
Salt and pepper
1 tablespoon of lard

Fry the peas in the lard, add water, and cook them with the lid on. When they are cooked strain off the water if any remains. Add a little more lard or butter, and when this is hot break the eggs whole into the pan. As they cook move them about as if scrambling eggs, adding the meat, sugar, and seasoning.

Scope for Adventure

This article should have shown that there is scope for New Zealand cooks, male or female, to adventure in Chinese cookery methods. To those who would do so one more piece of advice is necessary: It is experience that counts. One Chinese woman in New Zealand put it thus: "Nobody who has not previously cooked the Chinese way or seen how it is done can expect the first experiment to turn out well. If anyone can produce a palatable dish at her second trial, she should be congratulated. The encouraging thing about Chinese cookery is that once the basic principles are mastered—and they are very few—a great many dishes can be turned out, the variety being limited only by the scope of the imagination."

Food Consumption Levels



New Zealand's present level of food consumption may be in no way unique, and similar and even higher figures may be reached here and in other countries provided full employment can be maintained.

IN the constitution of the Food and Agriculture Organization of the United Nations it is laid down that this organisation shall "collect, analyse, interpret, and disseminate information relating to nutrition, food, and agriculture", and that it shall "promote and, where appropriate, shall recommend national and international action with respect to scientific, technological, social, and economic research relating to nutrition, food, and agriculture". This article by C. During, Assistant Investigating Officer, Department of Agriculture, Wellington, which deals briefly with pre-war and present consumption of food in New Zealand and compares the present food intake of New Zealand, the United Kingdom, and India, is based on information published by FAO.

FAO undertakes a great deal of fact finding to determine the most urgent needs and the most efficient way in which it could assist. For this purpose its Food Balance Sheets are extremely useful, because they show the quantities of all foodstuffs produced in the respective countries; the trade in foodstuffs; their disposition for use as animal feed, as seed, and for manufacture; and, hence, the national supply available for human consumption, together with the nutrient content of the supply. The nutrient content is expressed as proteins, fats, and calories contained in the food. Thus, in one table, a complete picture of the movement of the total food supply from the stage of farm production to the point at which it is available to the consumer can be seen, and comparisons can be made with consumption in other years and food supplies available in other countries.

The balance sheet stops short, however, at the total national supply of food available at the retail level. It does not estimate the waste occurring in retail markets and in homes, nor does the balance sheet show in any way how the food supply is distributed among different groups of people. To obtain information on variations in consumption among the different groups, dietary surveys would be needed. As the distribution of food within a country is of vital importance to the health and well-being of a community, such surveys are continually advocated by FAO.

Assessing Food Balance Sheet Items

In the drawing up of these Food Balance Sheets and estimation of the final figures each basic item has to be assessed according to its peculiarities. For instance, the intake of sugar, whether consumed in tea or ice-cream, by breweries or cake kitchens, is derived by dividing the net imports by the population. In the case of wheat, barley, and oats the production, the imports from overseas, and the amounts used for seed, animal feed, manufacture, and that wasted must all be considered. Again, the result is recorded not in the amount of bread, biscuits, and cake eaten, but in the amount of pure cereal and the calories, protein, and fat the cereal contains after milling.

Other factors must be taken into account in vegetable and meat consumption. A significant proportion of vegetables is grown in private gardens and must be added to commercial production; in assessing meat consumption, on the other hand, provision must be made for fat trimmed at the retail stage. Unfortunately the exact amount of trimming is unknown. Thus it will be seen that slight inaccuracies are likely to occur in the Food Balance Sheets, as all factors cannot be measured reliably, even in countries where accurate production and trade statistics are available.

The final nutrient content of the food supply is calculated as calories, protein, and fats. Calories measure the energy content or the heat-producing value of food and, as such, can serve broadly as a guide in determining the quantitative level of consumption. The publication of calorie consumption alone would not give any indication as to the quality of a diet. For this reason calculations on protein consumption are included and total proteins are further divided into animal and vegetable protein. This division gives an indication of the quality of proteins used, vegetable proteins tending to be of lower quality for building and replacing of body tissues than animal proteins. Moreover, diets high in animal proteins are associated with generous helpings of milk, meat, and fish, and such diets are also high in minerals and vitamins. International Food Composition Tables supplied by FAO assist in calculating the calories, proteins, and fats contained in single items of food.

New Zealand Consumption

In New Zealand consumption of food in terms of calories per head per year has not fluctuated considerably in recent years and has always been high; in the years immediately preceding the war it was estimated at 3160 calories per head. Strangely, this level was maintained during 1947 and 1948 despite meat, butter, and sugar rationing. In fact, the decline in the consumption of sugar, meat, and butter in the years following the war was entirely compensated by a greater consumption of milk, this having increased from 0.6 pints per head per day in the years 1935-39 to just under 1 pint in 1949. This is a big rise and represents an important improvement in diet. With the lifting of meat and sugar rationing the consumption of these items in 1949 increased considerably and reached pre-war levels, while the use of more milk than pre-war continued. At the same time the consumption of starchy foods did not decline. This resulted in a steep rise in apparent consumption of from 3150 calories in 1948 to 3400 calories in 1949. The effect of the abolition of butter rationing (June, 1950) will be reflected in the 1950 Food Balance Sheets, and calorie intake will show a further rise and may by now have reached 3450 calories per day.

Comparison with India and U.K.

In Table 1 (page 157) New Zealand's food intake is compared with that of India and the United Kingdom and with "recommended requirements". These "recommended requirements" represent estimates of consumption which would maintain perfect health plus an allowance of 10 to 15 per cent. for waste occurring in the retail trade and in the home. Because of India's warm climate, recommended estimated requirements for India are lower than those for countries with temperate climates, such as New Zealand and the United Kingdom.

It appears then from Table 1 that food consumed in both the United Kingdom and New Zealand is more than sufficient, while in India the available supplies fall far short of the ideal.

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TABLE 1 — FOOD CONSUMPTION AND RECOMMENDED REQUIREMENTS PER HEAD PER DAY

	United Kingdom 1948–49	India 1948–49	New Zealand 1949
Calories ..	3,030	1,620	3,400
Recommended requirements	2,750 grammes	2,500 grammes	2,750 grammes
Proteins ..	90.5	42.5	101
Animal ..	45.2	5.8	66
Vegetable ..	45.3	36.7	35
Fat	105	22.7	140

Importance of Distribution

Consumption of food (as shown in the Food Balance Sheets) based on recommended requirements of calories would presuppose perfect distribution of food within the country. The importance of this question of distribution can be realised if the average food intake of the United Kingdom before the war is taken as an example. For that period a consumption of nearly 3100 calories is shown, which was 2 per cent. more than for 1948-49. Yet Lord Boyd Orr, first Director-General of FAO, could point out that the diet of 4½ million people (10 per cent. of the population) was deficient in every constituent examined, while, at the same time, 13½ million people bought more than they needed. At present it is likely that rationing, school feeding programmes, and a better distribution of buying power have enabled the United Kingdom as a whole to be better fed despite the slightly lower intake of calories. The Food Balance Sheets are, therefore, a useful but limited guide to the nutritional standards of a country, because they obviously cannot take account of the distribution of food among various classes with different buying power or special needs, such as those performing heavy work, children, and pregnant and nursing mothers.

Quality of Diet

Figures showing the consumption of meat, fish, milk, vegetables, and fruit and the extraction rates of wheat and rice give valuable information relating to the quality of the diet, but the most useful figure is provided by the calculations of the protein content of the national diets. Table 2 shows the number of calories consumed in the form of protein and the percentage of calories consumed as protein in relation to total consumption. The "recommended requirements of protein" are based on calculations of minimum requirements of the healthy body for very low-quality proteins, plus a 10 per cent. allowance for waste in the retail trade and in homes. Minimum requirements from good protein sources are very much lower.

Table 2 shows two interesting facts. The protein consumption of New Zealand and the United Kingdom exceeds recommended requirements by a greater margin than consumption of total calories, while the Indian diet, though entirely inadequate in calories, shows a deficiency of similar magnitude in the intake of proteins. This will be reflected mainly in the health of those who need proteins most—mothers and children. In view of the severe cut in meat consumption it seems most surprising that the United Kingdom is consuming more protein now than before the war. The protein consumption of the United Kingdom is shown in detail in Table 3.



The amount of food consumed in Britain and New Zealand seems more than sufficient; in India supplies are insufficient. Upper—Mustering cattle in Westland. Middle—Indian peasants. Lower—Piccadilly Circus.

[*Upper photograph by National Publicity Studios.*

TABLE 2—CALORIES CONSUMED AS PROTEIN

	United Kingdom 1934–38	United Kingdom 1948–49	India 1948–49	New Zealand 1949
Total calorie intake	3,100	3,030	1,620	3,400
Total protein in calories	326	362	170	403
Protein intake as percentage of total	10.5	11.9	10.5	11.9
Recommended requirements of protein in calories ..	280	280	280	280
Excess of calorie intake over recommended requirements (per cent.)	12.7	10.1	—35.2	23.6
Excess of protein intake over recommended requirements (per cent.)	16.4	29.3	—32.1	44

TABLE 3—ANALYSIS OF PROTEIN CONSUMPTION IN U.K. BEFORE THE WAR AND IN THE YEAR 1948-49

	1934–38 Calories	1948–49 Calories
Proteins in:		
Meat	80	64
Dairy produce ..	60	77
Fish	25	28
Cereals	111	139



At present it is likely that rationing, school feeding programmes, and a better distribution of buying power have enabled the United Kingdom as a whole to be better fed despite the slightly lower average intake of calories. The photograph shows a picnic party on Monsal Dale, Derbyshire.

The higher intake of cereal proteins is due not only to greater consumption of cereals, but to the compulsory raising of the extraction rate for wheat flour. This measure resulted also in a higher content of thiamin (vitamin B_1) and iron in bread. The loss of animal protein due to meat rationing has been entirely made up by greater consumption of dairy produce, particularly fresh milk. Average consumption of fresh milk in 1948-49 was approximately 0.8 pints per head per day. The replacement of meat proteins by milk proteins doubtless has been assisted by heavy subsidies on milk and free school-milk programmes. Dietitians view the change as an advance, because milk not only contains valuable proteins but minerals and vitamins which are not supplied as adequately by meat. It may be said that on the whole the people of Great Britain enjoy a better diet than before the war, but, while the quality of the food has slightly increased, the calorie value has fallen. This decline in energy value could become of great significance if equitable distribution of food were not ensured by subsidies and direct rationing; and, in the absence of such measures, it seems likely that the nutritional status of a large part of the population of the United Kingdom would revert to the unsatisfactory pre-war levels.

Discrepancy in Consumption Levels

India and New Zealand are countries with not widely dissimilar food requirements, but the latter consumes over twice as much food per head as the former. This discrepancy is further heightened by the marked difference in the quality of the food and by the greater inequalities of incomes and distribution in India. These are the conditions which FAO set out to mitigate and improvement of which demands the closest study of economists, nutritionists, and agriculturists.

Compared with other countries, New Zealand's intake of 3400 calories per day per head seems unduly high, but a similar consumption level was reached by Denmark in the years 1934-38. It seems, therefore, that New Zealand's present level of consumption may be in no way unique and that similar and even higher figures may be reached here and in other countries provided full employment can be maintained. Hence New Zealand's present calorie consumption at the retail stage may be only a normal function of well-distributed high average incomes, full employment, lack of rationing, and a degree of waste of food which tends to accompany such conditions.

A large number of other countries with a fairly high standard of living and a reasonable standard of nutrition consume between 3050 and 3150 calories per head. Such countries are Sweden, Switzerland, Canada, and the United States. The Food Balance Sheets show that ample food supplies in countries of temperate climate are associated with a calorie intake of 3400 per head, while a reasonable standard can be maintained at a level of 3100 calories.

Tropical Countries

Little is known of the requirements of tropical countries under conditions of prosperity. Cuba, for example, has the highest food consumption among the tropical countries listed in the FAO Food Balance Sheets—2700 calories per head—but cannot be regarded as a country in which the people have reached a desirable standard of living. Despite the absence of representative data from tropical countries, the Food Balance Sheets illustrate effectively the difference between food consumption at a reasonable standard of living —3000 to 3400 calories in countries of temperate climates—and the theoretical requirements plus wastage in distribution—about 2700 to 2800 calories per head. This difference between actual desirable consumption levels and recommended requirements leads to two conclusions important to organisations such as FAO and to people interested in the physical and political welfare of the world.

First, the Food Balance Sheets show that recommended requirements of nutrients do not form a practical quantitative standard when considered as a national average, even if 10 to 15 per cent. is added to allow for wastage, but that a much higher standard must be adopted to allow for internal inequalities of distribution, which are difficult to avoid.

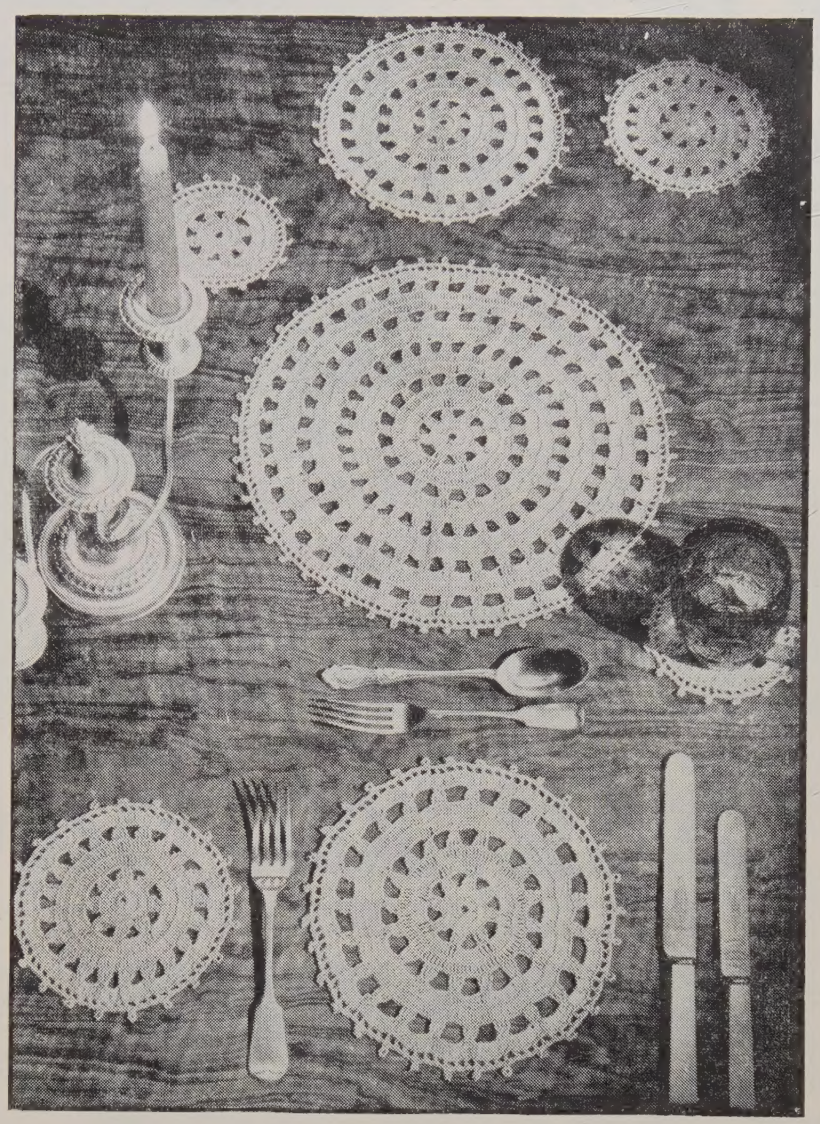
Secondly, putting of general knowledge of the widespread malnutrition endemic in many countries into figures which can be analysed easily shows how urgent is the need for the Western world to help under-developed countries to increase their food supplies. Failing such action, those people cannot be expected to maintain a political philosophy which enables their countries to be dealt with in an atmosphere of confidence.



Little is known of the requirements of tropical countries under conditions of prosperity.

CROCHET MATS IN CLUSTER PATTERN

THE instructions given in this article for the crochet mats in cluster pattern illustrated are planned for thread of size 16 to 18. If finer or thicker thread is used, it is a simple matter to adjust the number of increasings (and therefore the number of clusters) to keep the work flat.



Materials: 4oz. of rather coarse linen thread for 1 mat of each size; No. 2½ (or 17) steel crochet hook.

Measurements across: Centre mat, 12½in.; dinner plate mat, 8in.; bread plate mat, 5½in.; glass mat, 4½in.

Abbreviations: Ch., chain; s.c., single crochet; tr., treble; db. tr., double treble; rep., repeat; cont., continue; st., stitch(es).

To make a cluster: Work 1 db. tr. in first st., leaving 2 loops on hook; work 1 db. tr. in second st., leaving 3 loops on hook; work 1 db. tr. in third st., leaving 4 loops on hook; work 1 db. tr. in fourth st., leaving 5 loops on hook; then draw a loop through all loops on hook. At the beginning of a round work 4 ch. instead of first db. tr., thus leaving 1 less loop on hook each time.

Tension: 2 rows of db. tr. to measure ¾in.

The Centre Mat

The instructions for the centre mat are as follows:—

Make 10 ch. and join into a ring with s.c. First round: 3 ch., 19 tr. into ring. Join with s.c. to top of first 3 ch. (Finish all rounds with s.c. into top of first 3 or 4 ch.) Second round: 3 ch., 1 tr. into 3 ch., * 2 tr. in next tr. Rep. from * to end. Third round: *1 cluster, 8 ch., miss 1 tr. Rep. from * to end (8 clusters). Fourth round: 4 ch., 11 db. tr. into 8 ch. loop * 1 db. tr. into top of cluster, 11 db. tr. into 8 ch. loop. Rep. from * to end. Fifth round: 4 ch., 1 db. tr. into each db. tr. Sixth round: * 1 cluster, 7 ch., miss 2 tr. Rep. from * to end (16 clusters). Seventh round: * 4 ch., 8 db. tr. into 7 ch. loop (1 db. tr. into top of cluster, 9 db. tr. into next 7 ch. loop) 3 times. Rep. from *, working 1 db. tr. instead of 4 ch. when repeating. Eighth round: 4 ch., 1 db. tr in each db. tr. Ninth round: * 1 cluster, 8 ch., miss 2 tr., 1 cluster, 8 ch., miss 3 tr. Rep. from * to end (24 clusters). Tenth round: * 4 ch., 9 db. tr. into 8 ch. loop (1 db. tr. into top of cluster, 8 db. tr. into 8 ch. loop) twice. Rep. from * to end, working 1 db. tr. instead of 4 ch. when repeating. Eleventh round: 4 ch., 1 db. tr. in each db. tr. Twelfth round: * 1 cluster, 7 ch., miss 3 tr. Rep. from * to end (32 clusters). Thirteenth round: * 4 ch., (8 db. tr. in 7 ch. loop, 1 db. tr. into top of cluster) twice, 9 db. tr. in 7 ch. loop, 1 db. tr. in cluster, (8 db. tr. in 7 ch. loop, 1 db. tr. in cluster) twice, (9 db. tr. in 7 ch loop, 1 db. tr. in cluster) twice, 8 db. tr. in 7 ch. loop. Rep. from * to end, working 1 db. tr. instead of 4 ch. when repeating (299 db. tr. and 4 ch.). Fourteenth round: 4 ch., 1 db. tr. in each db. tr. Fifteenth round: * 1 cluster, 7 ch., miss 3 db. tr., 1 cluster, 7 ch., miss 4 db. tr. Rep. from * to end (40 clusters). Sixteenth round: * 4 ch., 8 db. tr. into 7 ch. loop, 1 db. tr. in top of cluster, 9 db. tr in 7 ch. loop. Rep. from * to end, working 1 db. tr. instead of 4 ch., when repeating. Seventeenth round: 5 ch., miss 1 db. tr., * 1 tr. in next db. tr., 2 ch., rep. from * to end. Eighteenth round: * 5 ch., (1 s.c. into each of 2 ch., 1 s.c. into tr.) twice, 1 s.c. into each of 2 ch. Rep. from * to end. Break off.

The Dinner Plate Mat

To make the dinner plate mat work as for the centre mat to end of tenth round; then work seventeenth and eighteenth rounds. If necessary, leave more than 1 db. tr. between tr. when working seventeenth round to keep work flat.

The Bread Plate Mat

The bread plate mat is worked as for the centre mat to end of seventh round; then work seventeenth and eighteenth rounds.

The Glass Mat

Work the glass mat as for the centre mat to end of fifth round; then work seventeenth and eighteenth rounds.

FARMHOUSE BREAKFASTS

By NELL MACPHERSON, Rural Sociologist, Department of Agriculture, Auckland

BREAKFAST is an important meal—possibly the most important of the day. Research has shown that muscular efficiency is at its lowest before breakfast but increases after a meal, and industrial-efficiency experts have found that people who do not eat breakfast are less efficient and more accident-prone than those who do. It has also been well established that breakfast should be a rather solid meal with a high calorie content and should contain a high proportion of protein foods, especially for people in occupations involving exposure to cold and wet, as it adds to comfort by promoting bodily warmth.

THE difficulty remains that a family needs 365 breakfasts every year, and sometimes it is difficult to meet nutritional standards and at the same time satisfy likes and dislikes and give interest to the meal by variation of the menu. The supply of foods also has seasonal fluctuations and, though many people may consider bacon and eggs the only breakfast, they cannot always be provided daily without a break. However, planning ahead allows the arrangement of a menu which will be of high nutritive value and will also use up left-overs from other meals. The menu can include meals which are easily cooked on mornings on which the demand on the housewife's time is heavy.

Seasonal foods can be introduced to vary the menus on this page. Mushrooms and onions when they are available can be used to replace tomatoes and eggs, and tree tomatoes, fried or grilled, make a welcome change. Fruits and tomatoes preserved during the season are available at any time of year. By adaptation of the menus for 3 weeks to suit individual families, this pattern can be used for a year, because few people remember what the breakfast was 3 weeks ago.

Breakfast Menus for 3 Weeks

	First week	Second week	Third week
Monday	Porridge or stewed fruit Bacon and tomatoes Toast and honey Milk coffee	Porridge Bacon and potato cakes Bread Tea (milk for children)	Porridge Macaroni cheese Toast Tea (milk for children)
Tuesday	Porridge Sausages in batter Toast and marmalade Tea (milk for children)	Porridge or stewed fruit Liver and onions Fried bread Milk coffee	Porridge Stewed mutton flap and potato Bread Milk coffee
Wednesday	Porridge Poached eggs on vegetable fritters Bread and honey Tea (milk for children)	Porridge or grapefruit Boiled eggs Toast and honey Milk coffee	Porridge or stewed fruit Steak Toast Tea (milk for children)
Thursday	Porridge Rissoles and tomatoes Toast and marmalade Milk coffee	Porridge Kidneys, bacon, and tomato Bread Tea (milk for children)	Porridge Fried fish Toast Milk coffee
Friday	Porridge or grapefruit Smoked fish and bacon Toast and honey Milk coffee	Porridge or stewed fruit Kedgeree Toast and marmalade Tea (milk for children)	Porridge Chops and tomatoes Milk Coffee
Saturday	Porridge or stewed fruit Bacon and eggs Bread and marmalade Tea (milk for children)	Porridge Mince Toast Milk coffee	Porridge or fruit Minced kidney and eggs Toast Tea (milk for children)
Sunday	Porridge or grapefruit Welsh rarebit Toast Milk coffee	Porridge or stewed fruit Scrambled eggs and tomato Bread Milk coffee	Porridge or grapefruit Bacon and baked beans Toast Milk coffee

Recipes

Most of the dishes given will be familiar, but the following recipes are given as a guide:—

Sausages in Batter

1lb. of sausage meat
3 tablespoons of flour
1 egg
Milk to mix if necessary

Beat the egg lightly, add it to the flour, and mix them lightly. Add milk if necessary to make a thin batter. Roll the sausage meat into sausage shapes. Coat them lightly with the batter and fry them in shallow fat. A pound of sausage meat provides 4 to 6 servings.

Vegetable Fritters

Chop a medium-sized onion finely and mix it with left-over vegetables. Add an egg if necessary to bind the mixture. Form it into cakes and fry them in shallow fat.

Welsh Rarebit

1 tablespoon of butter
1 to 2 cups of grated cheese
1 egg, slightly beaten
½ cup of milk
¼ teaspoon of baking soda
Salt and paprika to taste

Melt the butter, add the cheese, and cook them over hot water until the cheese melts. Add the salt, paprika, and baking soda to the egg, and then add the milk. Add this mixture to the cheese mixture and cook all until it is smooth and creamy, stirring gently to prevent lumps. Serve the rarebit on toast. The quantities given make 3 or 4 servings.

Kedgeree

3 tablespoons of fat
1 cup of cooked rice
1 cup of cooked fish
1 hard-boiled egg
Pepper, salt, and nutmeg as desired

Melt the fat and add the rice and fish. Season them and add the roughly chopped egg white. When the mixture is hot pile it into a hot dish and garnish it with the sieved egg yolk and lemon slices. These quantities make 4 servings.

Macaroni Cheese

1 cup of cooked macaroni
½ cup of grated cheese
2 eggs
2 tablespoons of milk
1 tablespoon of fat
Salt, pepper, and cayenne to taste

Beat the eggs in the milk and add them with the seasonings to the melted fat. Add the macaroni and stir the mixture gently until it thickens. Add the cheese and stir gently until it melts. Served on toast, these quantities provide 4 servings.

Stewed Mutton Flap and Potato

1 flap of mutton
2 medium-sized potatoes
1 medium-sized onion
1 cup of stock or water
Salt and pepper to taste

Cut the mutton into small pieces and put it into the stock. Chop the onion finely, quarter the potatoes, and add them to the stock with seasoning to taste. Cook all gently until the potatoes are well cooked. Bacon rinds may be added if desired.

This meal can be prepared the night before, and if home-killed meat is used, any small pieces of meat can be used instead of flap.

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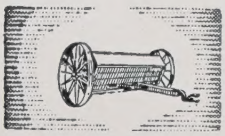
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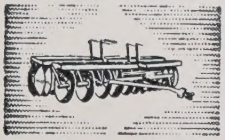
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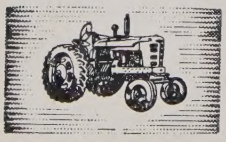
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